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MUNICIPAL ENGINEERING

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PORTLAND CEMENT MANUFACTURE.

PREPARATION OF SLAG-LIMESTONE MIXTURES.*

By Edwin C. Eckel, U. S. Geological Survey, Washington, D. C.

While the manufacture of Portland cement from a mixture of slag and limestone is similar in general theory and practice, to its manufacture from a limestone-clay mixture, certain interesting differences occur in the preparation of the mixture. In the following paragraphs the general methods of preparing mixtures of slag and limestone for use in Portland cement manufacture will first be noted, after which certain processes peculiar to the use of this particular mixture will be described separately.

General Methods—After it had been determined that the pozzuolanic cement made **by mixing slag with lime without subsequent burning of the mixture, was not an entirely satisfactory structural material, attention was soon directed toward the problem of making a true Portland cement from such slag. The blast furnace slags commonly available, while carrying enough silica and alumina for a cement mixture, are too low in lime to be suitable for Portland cement. Additional lime must be added, usually in the form of limestone, the slag and limestone must be well mixed and the mixture properly burned. The general methods for accomplishing the proper mixture of the materials vary in details. It seems probable that the first method used, in attempting to make a true Portland cement from slag, was to dump the proper proportion of limestone, broken into small lumps, into molten slag. The idea was that both mixing and calcination could thus be accomplished in one stage; but in practice it was found that the resulting cement was variable in composition and always low in grade. This method has accordingly fallen into disuse, and at present three different general processes or preparing the mixture are practiced at different European and American plants

1. The slag is granulated, dried and ground, while the limestone is dried and ground separately. The two materials are then mixed in proper proportions, the mixture is finely pulverized in tube mills, and the product is fed in a powdered state to rotary kilns.

2. The slag is granulated, dried and mixed with slightly less than the calculated proper amount of limestone, which has been previously dried and powdered. To this mixture is added sufficient powdered slaked lime (say 2 to 6 per cent.) to bring the mixture up to correct composition. The intimate mixture and final reduction are then accomplished in ball and tube mills. About 8 per cent. of water is then added, and the slurry is made into bricks, which are dried and burned in a dome or chamber kiln.

3. Slag is granulated and mixed, while still wet, with crushed limestone in proper proportions. This mixture is run through a rotary calciner, heated by waste kiln gases, in which the temperature is sufficient not only to dry the mixture, but also to partly powder it, and to reduce most of the limestone to quicklime. The mixture is then pulverized and fed into rotary kilns.

Of the three general processes above described the second is unsuited to American conditions. The first and third are adapted to the use of the rotary kiln. The third seems to be the most econom-

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**See Municipal Engineering, vol. xxiv, p. 335, May, 1903.

ical and has given remarkably low fuel consumption in practice, but so far has not been taken up in the United States.

Certain points of manufacture peculiar to the use of mixtures of slag and limestone will now be described.

Composition of the Slag—The slags available for use in Portland cement manufacture are of quite common occurrence in iron-producing districts. Those best suited for such use are the more basic blast furnace slags, and the higher such slags run in lime the more available they are for this use. The slags utilized will generally run from 30 to 40 per cent. lime. The presence of over 3 per cent. or so of magnesia in a slag is of course enough to render its use as a Portland cement material inadvisable; and on this account slags from furnaces using dolomite (magnesian limestone) as a flux, are unsuited for cement manufacture. The presence of any notable percentage of sulphur is also a drawback, though as will be later noted part of the sulphur in the slag will be removed during the processes of manufacture.

Granulation of Slag—If slag be allowed to cool slowly, it solidifies into a dense, tough material, which is not readily reduced to the requisite fineness for a cement mixture. If it be cooled suddenly however, as by bringing the stream of molten slag into contact with cold water, the slag is "granulated"—i. e., it breaks up into small porous particles. This granulated slag or "slag sand" is much more readily pulverized than a slowly cooled slag; its sudden cooling has also intensified the chemical activity of its constituents so as to give it hydraulic properties, while part of the sulphur contained in the original slag has been removed. The sole disadvantage of the process of granulating slag is that the product contains 20 to 40 per cent. of water, which must be driven off before the granulated slag is sent to the grinding machinery.

In practice the granulation of the slag is effected by directing the stream of molten slag direct from the furnace into a sheet iron trough. A small stream of water flows along this trough the quantity and rate of flow of the water being regulated so as to give complete granulation of the slag without using an excessive amount of water. The trough may be so directed as to discharge the granulated slag into tanks or into box cars which are usually perforated at intervals along the sides so as to allow part of the water to drain off.

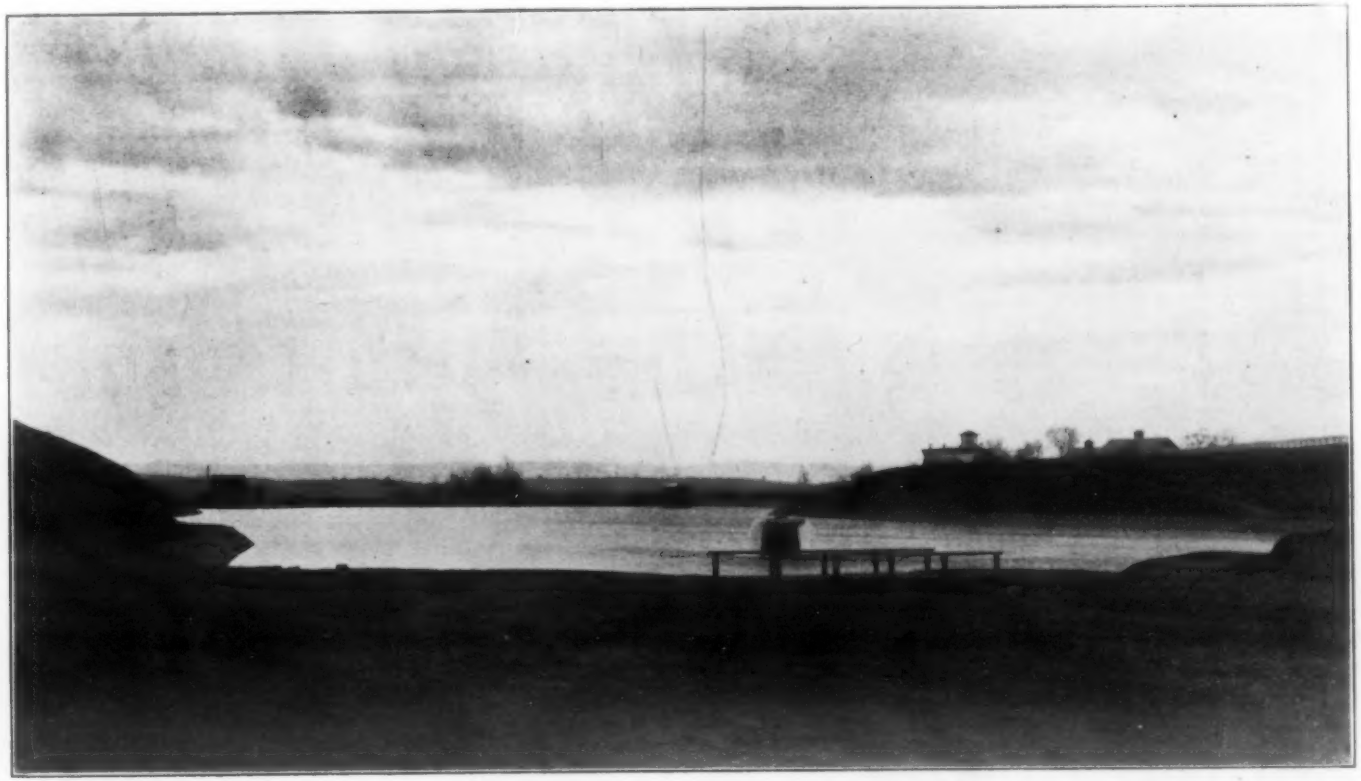
Drying the Slag—As above noted, the granulated slag may carry from 20 to 40 per cent. of water. This is renewed by treating the slag in rotary driers. In practice such driers give an evaporation of eight to ten pounds of water per pound of coal. The practice of slag drying is very fully described in volume 10 of the Mineral Industry, pages 84-95, where figures and descriptions of various driers are also given, with data on their evaporative efficiency. As noted earlier in this article, one of the methods of manufacturing Portland cement from slag puts off the drying of the slag until after it has been mixed with the limestone and then accomplishes the drying by utilizing waste heat from the kilns. Kiln gases could of course be used anyway in the slag driers, but it so happens that they have not been so used except in plants following the method in question.

Grinding the Slag—Slag can be crushed with considerable ease to about fifty mesh, but notwithstanding its apparent brittleness it is difficult to grind it finer. Until the introduction of the tube mill, in fact, it was almost impossible to reduce this material to the fineness necessary for a cement mixture, and the proper grinding of the slag is still an expensive part of the process, as compared with the grinding of limestone, shales or clay.

Composition of the Limestone—As the slag carries all the silica and alumina necessary for the cement mixture, the limestone to be added to it should be simply a pure lime carbonate. The limestone used for flux at the furnace which supplies the slag will usually be found to be of suitable composition for use in making up the cement mixture.

Economics of Using Slag-Limestone Mixtures—The manufacture of a true Portland cement from a mixture of slag and limestone presents certain undoubted advantages over the use of any other raw materials, while it has also a few disadvantages.

Probably the most prominent of the advantages lies in the fact that the most important raw material—the slag—can usually be obtained more cheaply than an equal amount of natural raw material could be quarried or mined. The slag is a waste product, and a troublesome material to dispose of, for which reasons it is obtained at small expense to the cement plant. Another advantage is due to the occurrence of the lime in the slag as oxide, and not as carbonate The heat necessary to drive off the carbon dioxide from an equivalent mass of lime-



I. LOWER DISTRIBUTING RESERVOIR, AMSTERDAM, N. Y.

stone is therefore saved when slag forms part of the cement mixture, and very low consumption is obtained when slag-limestone mixture is burned.

Of the disadvantages, the toughness of the slag and the necessity for drying it before grinding are probably the most important. These serve to partly counterbalance the advantages noted above. A third difficulty, which is not always apparent at first, is that of securing a proper supply of suitable slag. Unless the cement plant is closely connected in ownership with the furnaces from which its slag supply is to be obtained, this difficulty may become very serious. In a season when a good iron market exists, the furnace manager will naturally give little thought to the question of supplying slag to an independent cement plant.

The advantages of the mixture, however, seem to outweigh its disadvantages, for the manufacture of Portland cement from slag is now a large and growing industry in both Europe and America. Two Portland cement plants using slag and limestone as raw materials have been established for some time in this country, several others are in course of construction at present and it seems probable that in the near future Alabama will join Illinois and Pennsylvania as an important producer of Portland cement from slag.

THE WATER SUPPLY OF AMSTERDAM, N. Y.

Through the courtesy of Superintendent James R. Snell we are able to give a number of photographs of the reservoirs and conduits of the water supply system of Amsterdam, N. Y. The supply is obtained entirely by gravity from mountain streams and lakes, on some of the watersheds of which there are no inhabitants, and on the others there are but few.

Main-st. in Amsterdam is 282 feet above sea level. The lower distributing reservoir, two views of which are shown, is close to the city and is 577 feet above sea level. Some of the city is located at a still higher elevation. A few houses are seen in the picture. This is one of the early structures of the system and is fed by most of the reservoirs and diverting dams and conduits since constructed.

Kellogg reservoir and the masonry dam retaining the water are shown in two of the pictures. This reservoir is 732 feet above sea level. It is fed by the Hans Creek conduit, vitrified pipe, the diverting dam for turning water into which is shown in the fifth of the accompanying views. The elevation of this dam is 1,142 feet. Another diverting dam is located on Bunn creek, turning its waters into a 36-inch vitrified pipe conduit feeding the distributing reservoir. The sixth and seventh plates show the dam and the outlet end of the conduit.

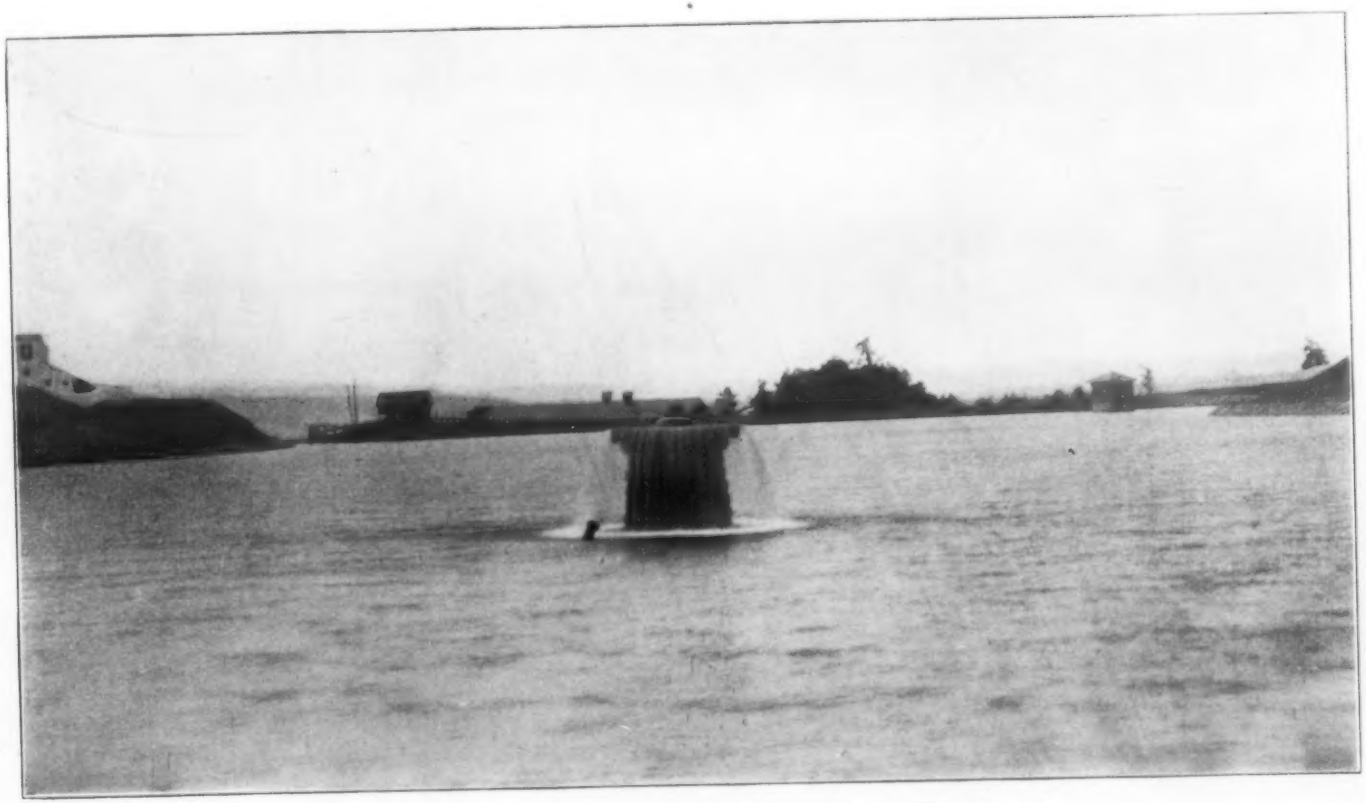
Another view shows Little Round Lake reservoir and the primitive condition of its banks. It is 1,499 feet above tide. Cook reservoir, whose dam is shown in one view, is in similar country 1,391 feet above tide.

The city recently completed Glenwild reservoir on Steele creek, which is 1,517 feet above sea-level and twenty-one miles from the city. The design for the dam is described in Municipal Engineering, vol. xxiii, p. 289. The capacity of this reservoir, 1,200,000,000 gallons, is greater than that of any other artificial reservoir in New York, except some of those of the city of New York. Its area is 168 acres, and the watershed tributary to it is 4.54 square miles. It is located about two miles above the Hans creek diverting dam and the entire watershed of Steele creek is without human habitation. Formerly there was quite a population in this district, interested in lumber, tanneries, glassworks, etc., but the removal of the original forests caused the abandonment of the sterile soil and it is now almost covered with second growth soft timber.

The entire watershed above the Hans creek diverting dam is 24.81 miles, and besides the Glenwild reservoir on Steele creek, it has Cook reservoir and Mooleyville lake on Hans creek, and Little Round lake and little Hans lake on branches. There are but two residences on Hans creek, and one at Glenwild reservoir used for waterworks purposes.

Aside from the exceptional character of its watersheds, the notable feature of the Amsterdam water works is the free use of vitrified pipe in the conduits. The Hans creek diverting dam is located about nineteen miles from the city. No conduits are necessary above that point, as may be inferred from the description of the watershed above.

There are about 14 miles of conduit in



II. FOUNTAIN, LOWER DISTRIBUTING RESERVOIR, AMSTERDAM, N. Y.

the Bunn creek and Hans creek lines, iron pipe being used where the conduit is under pressure and vitrified clay pipe where the line can be laid on the hydraulic grade line. Some of this pipe has been in use for about twenty years. The last annual report states that the only repairs necessary during the year were the relaying of 150 feet of eighteen-inch pipe and repairing of several small leaks on the Hans creek conduit line.

COSTS AND PRICES OF GAS AND ELECTRIC LIGHTING BY MUNICIPAL PLANTS.*

By Alton D. Adams, Boston, Mass.

Electric lighting by municipal plants in Massachusetts covers a period of thirteen years and the record of their operations is complete. Before June 30, 1892, only a single plant was in operation, and since June 30, 1900, eighteen plants have been in operation. From 1893 to 1901 the record of service in operating expenses is practically complete. From 1897 the figures for interest and depreciation charges against each plant are also available. Expenses of operation do not include entirely new construction.

Some of the plants have operated private as well as street lamps from the start, others added commercial service at dates subsequent to the beginning of public lighting, and all save Needham and Wellesley were supplying private consumers in 1901. As street and commercial lamps are operated from the same stations and often by the same machinery, no attempt is made to determine the portions of operating expenses that should be assigned to each of these two classes of service. The aim has been simply to determine the actual cost of street lighting to each town or city, represented by the difference between the operating expenses and money income of its plant. Only in cases where plants were devoted entirely to public lighting do the costs here found correspond, necessarily, to the actual costs of this service. This is evident from the fact that the municipal plants may have either made or lost money on their commercial business, thus making the cost of street lighting appear less or greater than the actual. As the costs here given represent the net results to the cities and towns concerned, the question as to what portions of operating expenses were due to public and commercial service respectively is of minor importance. In each case the money income of the plant is deducted from the total expense of operation and maintenance and the remainder is divided by the number of kilowatt-hours supplied to street lamps, to determine the average cost per kilowatt-hour. The total number of kilowatt-hours supplied to street lamps by each plant is computed from the candle powers of the lamps and the number of hours during which each was operated in the year in question. For arc lamps 0.25 watt, and for incandescent lamps 3.5 watts have been allowed per candle power hour.

Of the eighteen cities and towns under consideration, nine have built their electric plants. In the other nine cities and towns the initial plants were purchased of corporations formerly owning them. The prices paid for these plants, pursuant to judgments of the courts in seven cases, have been excessive. Data for costs of street lighting in these two groups of nine plants each are, therefore, presented separately. So far as complete data are available, the expenses of street lighting per kilawatt-hour are given for each year and plant.

Of the nine towns that built their plants, Table I, three, Braintree, Peabody and Needham, show little general change in the expense of operation per kilowatt-hour between earlier and later years. In the other six towns of the group the tendency has been toward decidedly lower costs.

Marked variations of cost in the same place for different years, as well as between different places in the same year, are due in large part to the influence of commercial business. If money is lost on this business the loss appears entirely as an increase in the cost of street lighting. If the commercial business yields a profit this profit reduces and may even wipe out the cost of street lighting.

The plants in Needham and Wellesley do no commercial lighting, so that the figures presented show the actual cost of operation and maintenance for street lamps per kilowatt-hour. In these two towns the costs are not far apart and vary but little from year to year.

For each year the cost of street light-

*Copyright by A. D. Adams.

III. KELLOGG RESERVOIR, AMSTERDAM, N. Y.

ing in all the nine municipal plants together is divided by the total number of kilowatt-hours devoted to this service, to obtain the average cost per kilowatt-hour in the nine towns. These average costs show an almost constant decline from 7.1 cents per kilowatt-hour in 1893 to 4.0 cents in 1901. Such a showing is certainly favorable to the efficiency of management in these municipal plants.

TABLE I.

EXPENSES OF OPERATION AND MAINTENANCE PER KILOWATT-HOUR FOR STREET LIGHTING IN PLANTS BUILT BY TOWNS.

	1893	1894	1895	1896	1897	1898	1899	1900	1901
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Danvers	10.3	9.5	9.6	8.1	9.3	6.9	7.5	7.2	6.1
Braintree	5.1	5.3	5.9	5.2	5.3	7.4	6.6	5.8	5.5
Peabody	5.5	4.7	4.8	4.1	4.1	3.9	4.1	4.3	5.1
Wellesley	11.7	.....	.....	.....	6.0	5.8	4.6	5.9	5.3
Needham	.....	.....	.....	3.8	5.6	5.9	6.8	5.7	5.5
North Attleboro	.....	10.9	5.6	2.9	3.4	3.0	1.8	2.0	1.7
Marblehead	.....	.....	2.7	3.0	3.4	2.8	3.0	1.9	1.5
Reading	.....	.....	.....	11.4	8.4	8.6	9.3	7.5	5.7
Concord	.....	.....	.....	.....	.....	.....	.....	4.2	3.9
Averages	7.1	5.8	5.4	4.6	4.9	4.8	4.7	4.3	4.0

Turning now to the nine cities and towns that purchased plants from private corporations, Table II, the variations in cost of street lighting between different plants and between different years for the same plant are more notable than was the case with the other nine plants built by the towns. These wide differences must be assigned in part at least to the influence of commercial business which has been of greater volume in the purchased plants.

The costs of operation and maintenance average somewhat higher in the purchased plants than in those that were built. This result seems to be due in part to the low efficiency and poor arrangement of the old style plants that the cities and towns were forced to purchase. The word "gain" used in the table indicates that the income of a plant from commercial business was greater than the entire expense of operation in a particular year. The averages for operating expenses are thus, not very far apart in the two groups of plants.

When interest and depreciation charges are added to the expenses of operation and maintenance, however, marked differences appear in the total costs of street lighting by the built and purchased plants.

Under Massachusetts law depreciation is charged against municipal gas and electric plants at a rate of not less than 5 per cent. on their costs as shown by their books at the beginning of each year. Interest charges against these plants are computed on their total investments at the beginning of each year

TABLE II.

EXPENSES OF OPERATION AND MAINTENANCE PER KILOWATT-HOUR FOR STREET LIGHTING IN PLANTS PURCHASED BY TOWNS AND CITIES.

	1894	1895	1896	1897	1898	1899	1900	1901
	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Middleboro	7.4	5.1	4.1	4.0	Gain.	2.3	1.3	Gain.
Hingham		6.4	6.6	7.7	7.9	6.7	5.9	6.3
Wakefield		13.3	13.5	14.4	10.3	7.8	6.1	6.7
Hull		13.3	11.9	22.2	4.5	11.5	0.1	5.7
Chicopee		.....	9.8	8.2	6.5	7.1	6.5	6.5
Hudson		.....	.....	10.6	10.2	6.5	7.6	4.2
Taunton		.....	.....	.....	2.0	2.2	1.4	2.5
Belmont		.....	.....	.....	3.4	19.9	10.9	14.3
Westfield		.....	.....	.....	.....	Gain.	1.2	1.5
Averages	7.4	7.8	7.8	9.2	3.7	5.4	4.0	4.4

at the same rate as that paid on municipal bonds. Complete records of these interest and depreciation charges are only readily available for 1897 and later years, and the tables of complete costs of street lighting have accordingly been constructed from this period.

Considering first the towns that built

IV. MASONRY, KELLOGG RESERVOIR, AMSTERDAM, N. Y.

their initial plants, Table III, the charges for interest and depreciation have formed an increasing portion of the total costs of lighting at most plants. It seems that the average charges for interest and depreciation have increased to about the same extent that operating expenses have declined, thus holding the total costs per kilowatt-hour within a range of 10 per

TABLE III.
TOTAL COST OF STREET LIGHTING PER KILOWATT-HOUR IN PLANTS BUILT BY THE TOWNS.

	1897	1898	1899	1900	1901
	Cents.	Cents.	Cents.	Cents.	Cents.
Danvers	9.9	5.2	10.6	13.0	12.2
Braintree	9.9	13.0	12.6	12.6	13.7
Peabody	7.9	7.6	7.6	6.7	6.2
Wellesley	7.7	7.7	6.6	7.6	7.1
Needham	8.3	8.7	9.5	9.4	7.6
North Attleboro	7.8	8.5	7.8	8.1	7.3
Marblehead	7.7	7.0	7.3	5.5	5.2
Reading	16.3	19.4	19.4	17.9	14.6
Concord	.....	.....	.....	8.2	7.6
Averages	7.7	8.6	9.2	8.4	8.5

cent. for the earlier and later years. Beginning with 1897 the percentages of average total costs represented by the sum of interest and depreciation charges in each year for plants built by towns have been 44.8, 48.4, 48.8, 49.7 and 51.6, respectively, down to 1901, inclusive.

Plants purchased by cities and towns, Table IV, present very different relations for operative costs and interest and depreciation charges. In these nine plants costs of operation have constantly been less than one-half of the total since 1897. For the years beginning with 1897 the percentages for the sums of interest and depreciation charges to total costs are 50, 68.9, 62.1, 72.9 and 59.9, respectively, down to 1901. In the earlier years the heavy charges for interest and depreciation on the purchased plants raised the average total costs of street lighting in them to nearly double the amounts per kilowatt hour charged against the plants that were built. Later as large sums have been charged off to depreciation in the purchased plants, and as commercial business has increased, the average costs of street lighting in the built and purchased plants have drawn nearer together. This movement toward uniformity has been due to reductions of costs per kilowatt-hour in the purchased plants. In 1897 the average cost at these plants was 18.6 cents per kilowatt-hour, but for 1901 this average was down to 10.7 cents.

Reductions in the cost of street lighting in the purchased plants have been made by means of high rates for commercial service. The rates for service to private consumers by municipal plants are required by law to be uniform to all who receive the same kind and amount of service from any one plant, and the rates must be made public. Such regulations do not prevent low prices as discounts to large consumers. Rates given in Table V have all been reduced to cents per kilowatt-hour by an allowance of 56 watts per 16-candle lamp where rates were in cents per lamp hour.

Commercial rates at the seven points supplying private consumers have generally remained uniform from 1895 to 1901, changes made having been slight, except at Peabody from 1896 to 1897. Disregarding Peabody in 1896 the commercial rates have been between 10 and 15 cents per kilowatt hour, the lowest being Danvers. Of the forty rates given in the table four were 15 cents, eighteen were 13.4 cents,

TABLE IV.
TOTAL COST OF STREET LIGHTING PER KILOWATT-HOUR IN PLANTS PURCHASED BY CITIES AND TOWNS.

	1897	1898	1899	1900	1901
	Cents.	Cents.	Cents.	Cents.	Cents.
Middleboro	10.7	16.3	24.5	25.4	19.8
Hingham	10.5	11.0	9.0	6.8	8.0
Wakefield	23.4	22.4	20.3	17.0	16.4
Hull	48.8	26.0	51.2	30.2	33.5
Chicopee	16.0	14.9	15.0	11.4	12.1
Hudson	23.8	28.4	15.8	18.5	14.3
Taunton	.....	13.1	11.3	9.1	8.3
Belmont	.....	.....	24.7	15.3	18.7
Westfield	.....	.....	.....	4.9	4.5
Averages	18.6	16.8	14.8	11.8	10.7

three were 13 cents, two were 12 cents, seven were 10.7 cents, five were 10 cents and one was 8.9 cents per kilowatt hour.

The municipal plants that were purchased also present moderate changes in commercial rates. Table VI. These plants show much wider differences as to commercial rates than do the plants which towns built. The lowest rate in

V. HANS CONDUIT DIVERTING DAM, AMSTERDAM, N. Y.

the purchased plants was that of 11.85 cents per kilowatt hour at Chicopee, and the highest rate was 25 cents for an equal amount of energy at Hull. At the Westfield plant rates are $1.25 per month for each 16-candle-power lamp burning every night until 11 o'clock, and smaller sums for shorter hours of service. No attempt is made to reduce this to a charge per kilowatt hour. Of the forty-six rates given in the table three were 25 cents, eighteen were 20 cents, two were 18.75 cents, thirteen were 18 cents, four were 15 cents, one was 13.4 cents and five were 11.85 cents per kilowatt hour.

TABLE V.

CENTS PER KILOWATT-HOUR CHARGED FOR COMMERCIAL SERVICE IN EACH YEAR BY PLANTS BUILT BY TOWNS.

	1895	1896	1897	1898	1899	1900	1901
Danvers			10.0	10.0	10.0	10.0	10.0
Braintree	10.7	10.7	10.7	10.7	10.7	10.7	10.7
Peabody		8.9	13.4	13.4	13.0	13.9	13.0
North Attleboro	13.4	13.4	13.4	13.4	13.4	13.4	13.4
Marblehead	13.4	13.4	13.4	13.4	15.0	15.0	15.0
Reading		13.4	13.4	13.4	13.4	13.4	15.0
Concord						12.0	12.0

It appears that commercial rates are 33 to 66 per cent. higher among the plants that cities and towns were forced to purchase from private corporations than among the plants freely built by towns. The main reason for this difference in rates is found in the excessive prices paid for the purchased plants, because the law requires that the commercial rates of municipal plants be sufficient to cover interest on the investment, sinking fund and depreciation charges and operating expenses.

Three towns in Massachusetts operate gas plants. All of these plants were purchased by the towns from private corporations since the municipal ownership act of 1891. Middleboro made its own bargain, but Wakefield and Westfield were compelled to purchase at prices much above the necessary cost of construction for new plants. Under these conditions it is not to be expected that the municipal gas plants could make a very favorable showing, especially as their properties while in the hands of the former owners had not yielded satisfactory returns for some years. At Middleboro the product is oil gas, and at Wakefield and Westfield coal gas. The gas plants have almost exclusively supplied private consumers. The small amounts of gas used in public buildings have been charged to the towns at regular rates.

At Middleboro, Table VII, the cost of operation per 1,000 cubic feet of gas made shows rather wide fluctuations, though the candle-power of the gas has varied only 10 per cent. from 24.75 to 26. No facts that are available explain the variations

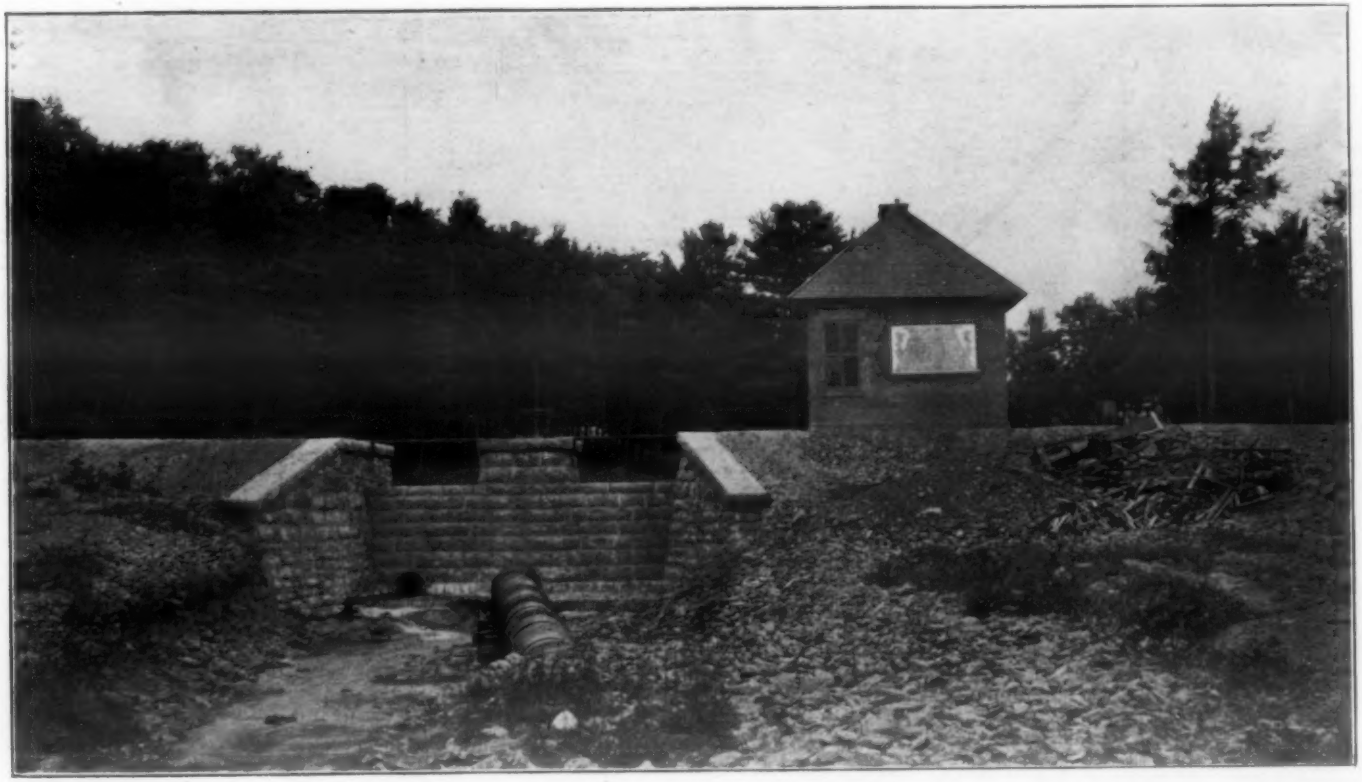
TABLE VI.

CENTS PER KILOWATT-HOUR CHARGED FOR COMMERCIAL SERVICE IN EACH YEAR BY PLANTS THAT WERE PURCHASED.

	1895	1896	1897	1898	1899	1900	1901
Middleboro	18.0	18.0	20.00	15.00	15.00	15.00	15.00
Hingham	20.0	20.0	20.00	20.00	20.00	20.00	20.00
Wakefield	18.0	18.0	18.00	18.00	18.00	18.00	20.00
Hull	18.0	13.4	18.75	25.00	25.00	25.00	25.00
Chicopee			11.85	11.85	11.85	11.85	11.85
Hudson			18.00	20.00	20.00	20.00	20.00
Taunton				18.00	18.00	18.00	20.00
Belmont				20.00	20.00	20.00	20.00

of cost at this plant. This cost has tended downward somewhat. The costs at Wakefield, candle-power considered (17.4 to 18.7) make a much better showing. The Westfield plant furnished coal gas at a cost of 75 cents per 1,000 feet, exclusive of interest and depreciation, an excellent showing for so small a plant.

The total cost of gas at each plant, in-



VI. BUNN CREEK DIVERTING DAM AND 36-INCH DIVERTING CONDUIT AMSTERDAM, N. Y.

cluding interest and depreciation, computed as for electric light plants, is given in one column of the tables.

For all the plants the ratio of operating expenses to total cost has risen from 47 to 68 per cent. because the plants are gradually being cleared by the depreciation charges of the burden imposed by the excessive prices at which they were purchased.

TABLE VII.

GAS MADE BY MUNICIPAL PLANTS.

	Cubic feet gas made.	$ Cost operation per 1,000 feet.	$ Total cost per 1,000 feet.	$ Average price per 1,000 feet.	Cents profit per 1,000 feet.	Per cent. operation to total cost.
Middleboro—						
1894	711,388	2.60	.....	2.75	7	.....
1895	957,989	3.40	.....	3.64	15	.....
1896	1,294,040	3.71	.....	2.69	— 83	.....
1897	1,583,400	2.51	5.18	2.62	— 33	48
1898	1,657,465	1.72	3.85	2.64	27	44
1899	1,504,695	2.12	4.32	2.61	— 6	49
1900	1,524,400	2.01	3.72	2.63	19	54
1901	1,610,800	2.18	3.72	2.47	— 5	58
Wakefield—						
1895	8,733,000	1.13	.....	1.70	57	.....
1896	7,313,000	1.11	.....	1.73	52	.....
1897	7,450,000	1.09	2.55	1.74	57	42
1898	7,318,000	1.09	2.52	1.76	57	43
1899	7,712,000	1.11	2.11	1.75	62	52
1900	8,867,000	1.09	2.05	1.73	58	53
1901	13,368,000	1.00	1.75	1.61	56	57
Westfield—						
1899	786,300	0.87	1.71	1.81	96	50
1900	15,632,800	0.75	1.24	1.64	85	60
1901	17,317,800	0.75	1.21	1.63	84	61

Average prices at Middleboro have been relatively high after allowance for the one-third greater illuminating capacity. All three plants show small reductions of price during their periods of operation.

Not quite all of the gas made is sold because a little is used at the gas works and some is lost by leakage. Consequently the average price in each case applies to a somewhat smaller number of feet than does the average cost of operation. Besides the sale of gas the coal gas plants at Wakefield and Westfield derive some income from residuals, but this is not true for Middleboro. The apparent profit per 1,000 feet of gas made is found in each case by a division of the total profits or losses of the manufacturing business by the total number of thousand feet of gas made, not by subtraction of average selling price from average cost of operation. A loss is indicated in the table by the minus sign. Middleboro has incurred losses in four years and gains in four years. Wakefield and Westfield have uniformly gained a good percentage.

The good showings at Wakefield and Westfield make the possible results in municipal gas plants, freely built at fair cost, a very interesting question.

THE MANUFACTURE AND STRENGTH OF SAND BRICK.

The fifth volume of the transactions of the American Ceramic Society, Edward Orton, jr., secretary, Columbus, O., contains a detailed article of nearly 60 pages by S. V. Peppel on the manufacture of artificial sandstone or sand brick. The volume is copyrighted and can be obtained for $4. The article in question has been issued separately at a price of 50 cents.

Mr. Peppel proposes to restrict the term "sand brick" to combinations of sand with calcium, calcium-magnesium, or magnesium silicate, formed by the action of steam under pressure upon silica or quartz and calcium or magnesium hydrates, or a mixture of both of them. This would cut out some of the methods of hardening the brick which are described in Stoffler's "Silico-Calcareous

VII. OUTLET END 36-INCH BUNN CREEK DIVERTING CONDUIT, AMSTERDAM, N. Y.

Sandstones," but practically this is of little account, since all the practical processes uses steam under pressure as the hardening agent and nearly all of them use high pressure.

A laboratory was fitted up for making briquettes for determining tensile and compressive strength of sand brick made according to various processes, and the various facts collected during the experiments are discussed under six heads.

1. The Raw Material and Its Preparation.—It was found that almost any sand can be forced to produce a fair product by proper variation in treatment to suit its physical and chemical properties, but there are limitations dictated by economy in manufacture and durability of product. Thus, too much clay in the sand makes the bricks short-lived in severe weather. Comparatively pure sand is essential to cheap manufacture and fineness less than No. 20 sieve, unless sizes are well graded. The sand having the least percentage of voids is the best, other things being equal. Some experiments on a mixture of sand and pure potters' flint for fine material were made. The sand had 50 per cent. of size between No. 20 and No. 40 sieves, 33 per cent. between 40 and 60, 7 per cent. each between 60 and 80, and 80 and 100 and 3 per cent. between 100 and 150. The flint had 3 per cent. between 100 and 200 mesh, 65 per cent. between .00212 inch and .000136 inch diameter, and 32 per cent. too fine for measurement. The results of the tests showed a decrease in crushing strength from 3,114 pounds per square inch with 8 parts of the coarse and 2 parts of the fine to 2,641 pounds with 3 parts of the coarse and 2 parts of the fine. At the same time the tensile strength was increased from 131 pounds per square inch with the former mixture to 224 pounds with the latter. These experiments simply show the desirability of tests of any proposed sand and of the determination of methods of improving it if found necessary for the best results. The control of the product by means of frequent examinations of the sand is also indicated.

The paper concludes that if a No. 40 screen is used at least one-fourth of the sand must be ground to pass through a 150 mesh, and if the sand is well graded in size an amount of the fines equal to the lime used should be added. The fines accelerate the chemical action of hardening. Closer experimentation may show more clearly the relations of sizes needed to produce the minimum of voids, and may even show as in the case of the larger materials used in Warren's bitulithic pavement, that the best result is obtained a little short of the minimum of voids if the proper sizes to omit are determined.

The effect of clay as an impurity in the sand was studied in some detail. For briquettes made under a pressure of 15,000 pounds per square inch in molding, both crushing and tensile strength decreased with an increase in the percentage of clay, being a third or more on an increase from 2.5 to 20 per cent. of clay. Under 15,000 pounds molding pressure briquettes made with double the percentage of lime showed decrease in crushing strength of one-sixth to one-third, but increase in tensile strength of similar proportions. Increase in lime to 20 per cent. increased the strength of briquettes with two parts clay and three parts sand so that they were stronger than those of three parts coarse and two parts fine sand and five parts lime. In other words, increase in percentage of lime offset the effect of the clay. This effect was partly nullified in aging the briquettes, so that in addition to increasing the cost of bricks on account of the increase in lime the durability is somewhat affected. The paper concludes that clay up to 10 or 12 per cent. is probably not dangerous and that perhaps 2.5 per cent. might be desirable. Clay makes the molding process easier.

The effect of feldspar as an impurity in the sand is more complex and is not so serious. It deserves further study. Burnt clay used in place of fine sand cuts the compressive strength in two.

The amount of lime to be used was tested. Doubling the amount of dolomitic lime increased the strength 50 per cent. Multiplying the proportion of lime by 8 multiplied the strength by 2.5. The increase is not in proportion to the increase in cost. The common practice of using not more than 10 per cent. of lime is commended, provided the sand is clean.

The difference in value of gray lime made from limestone having 85 per cent. or more of calcium carbonate and of white lime made from dolomitic limestones nearly half carbonate of magnesia was tested, the results showing, with 10 per cent. of lime in the brick mixture, a strength of the bricks with pure lime 50 per cent. greater than that of bricks made of the magnesian lime.

In preparation of the sand it may be necessary to crush soft sand rock, to dry at least partially sand obtained by dredg-

VIII. ROUND LAKE RESERVOIR, AMSTERDAM, N. Y.

ing, to wash out clay or soluble salts and in some cases to grind part of the sand very fine in ball, tube or Griffin mills. Some foreign manufacturers roast the sand, but the utility of the process is not well settled.

The lime must be slaked either before or after mixing with the sand, the time required to slake dolomitic lime demanding the former. Most of the patents on sand brick are on methods or machines for slaking lime and mixing with the sand and utilizing the heat generated in the process. The paper suggests several methods of manipulating the mixture of the two materials.

2. Behavior of the Mixture in the Press.—Experiments were made with bricks made by mixing dry sand and ground lime to determine the most suitable pressure for compressing the bricks with the result that 15,000 pounds per square inch produced stronger briquettes than either greater or less pressures. The behavior of the blocks in the press is also considered in the paper.

3. Hardening.—The tests on this process showed that at 150 pounds steam pressure the maximum hardening effect was produced in about 4 hours, that at 120 pounds 6 to 8 hours' time is necessary and at 100 pounds 8 hours or perhaps more. The usual practice of using 120 pounds pressure for 8 to 10 hours is commended.

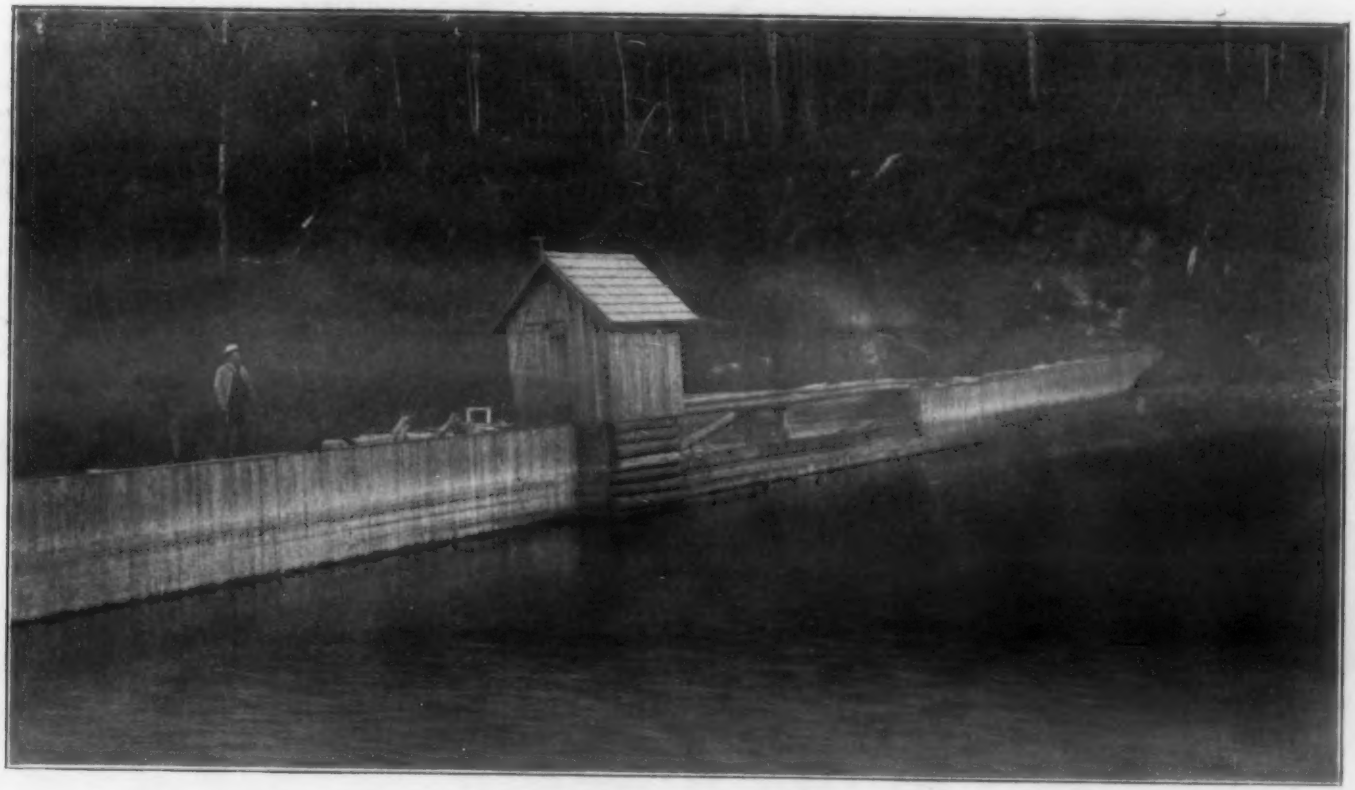
Testing.—Fractures under crushing loads are like those in hard stone. Cubes frozen and thawed twenty-one times in succession showed actual increase in strength, due perhaps to hardening action of carbonic acid in the water used to thaw the blocks. Samples made of pure sand stood about 2,300 degrees F. of heat in muffle. Those containing clay or feldspar exploded before reaching high temperatures. Absorption of water was about 8 to 10 per cent in forty-eight hours usually nearer the lower limit. The paper gives a comparison of sand brick with averages of natural sandstone from Wisconsin, showing practically the same weight, 136 pounds a cubic foot absorption, 10 per cent. greater in sand brick. Crushing strength, 7,745 pounds per square inch for sand brick as compared with 6,535 pounds for the sandstone, coefficient of elasticity say four times as great, being 600,000 for sand brick.

5. Mechanical Equipment. — Under this heading the paper considers the mixing apparatus, including edge runners, wet and dry pans, pug-mills of various sorts and the Schwarz system, which controls the amount of moisture; lime-preparing machinery; presses, including the Kahl and Komnick, expressly designed for sand brick, and the American dry-press brick machines which have been applied; hardening cylinders; tracks and trucks.

6. Discussion of the Merits of Systems. —Five processes or systems are considered including the Komnick, Kieber, Brown, Schwarz and Huennekes.

The process of hardening with steam under pressure was invented by Dr. Michaelis, and has been presented to the public. There are several patents in this country which actually cover special methods of applying the process only. All have been issued within the past five or six years. Those of any value are described in the paper, and others are explained to show their impracticability.

Under nine of the patents good bricks can be made, and by five of them the author thinks the cost of making brick under the same conditions would not vary more than 35 cents a thousand. The cost of plants varies according to local conditions. A plant to make 20,000 bricks in ten to twelve hours would cost in Ohio without real estate, $20,000 to $25,000. The cost of production, not including depreciation and interest on investment varies from $2.50 to $4 per thousand, and the selling price ranges from $8 to $15 in various localities. The fact that only seven to eight million of the brick were made in the United States in 1902 indicates that these figures of cost may not be fully representative.



IX. COOK RESERVOIR DAM, AMSTERDAM, N. Y.

EDITORIAL COMMENT

Municipal Ownership of Lighting Plants.

A Case in Engineering Ethics.

Two Coming Municipal Conventions.

MUNICIPAL OWNERSHIP OF LIGHTING PLANTS.

The discussion of the question of municipal ownership of a lighting plant is under discussion in Cleveland, O., as stated in this department last month, and there are echoes of the discussion in the public press throughout the country. As is usual when such discussions get into political campaigns each side is contending, not for the truth, but for the success of its party, and as a consequence each side presents many statements of fact which are not applicable to the case under consideration and bases upon these statements arguments which are equally inapplicable, though made to appear valid when superficially considered.

Cleveland seems to have been fortunate, so far as rates for public lighting are concerned, first in securing a fairly reasonable rate per light per year, and second, in securing material reductions in this rate from time to time, so that the price now paid is appreciably less than that paid by most cities of similar size and condition and is not far from the average of all cities large and small. The fact is that large cities pay appreciably more per lamp per year than the smaller cities and Cleveland, though a large city, has the advantage of the price usual in small cities.

This would seem to be a sufficiently strong argument for a continuance of the present condition, especially since comparisons of costs of street lighting under private and municipal ownership, many of which have appeared in this magazine, show that the average advantage of municipal ownership over private ownership is not sufficient to overcome the lead which Cleveland has been able to secure over its sister cities in its electric lighting contract. The opponents of municipal ownership materially weaken their case by bringing in comparisons with cities in which the effect of political manipulation upon municipal plants is notorious, thus begging the question. An argument that politics cannot be kept out of municipal operations may have very good basis, but it is an argument which no good citizen, who believes in the future of his city, is willing to present baldly. It can only get in under some such side issue as this.

Another weak argument, coming up often in the present controversy, is that drawn from a comparison with the cost under municipal ownership under different conditions. The operations of the Chicago municipal lighting plant, for example, might well be quoted in favor of either side of this case. It is true, no doubt, that the total cost per light in the Chicago plant is somewhat greater than the price paid in Cleveland. The conditions, however, are entirely different—so different that comparison is not possible. The Chicago plant can furnish nothing but street light. The Cleveland company has an enormous private business in addition to its city contract. Reference to Mr. Adams's paper on "Costs and Prices of Gas and Electric Lighting by Municipal Plants" will show that the effect of the income from private consumers upon the cost of street lighting in small municipal plants is very great. In large plants it is still greater, and it is doubtless true that the profit on private service in Cleveland is more than the receipts from the public service. Since the right to perform the private service was originally, and is now to a large extent, dependent upon the ability and willingness to perform the public service, it is not surprising that under pressure a company should be willing to perform the public services at even less than it would cost if furnished alone, that it may continue its private business. Moreover, the public business, as an addition to its other operations, does not add to its expenses an amount equal to the cost in an independent public lighting plant.

The question of rates for private service is a very important one in this connection, and it is a question which is not discussed by the opponents of municipal ownership. It may well be that the rates for such service are higher than they should be, and that the low rate for pub-

lic service is granted as a bribe for maintaining rates for other service which are exorbitant. This does not make an argument for municipal ownership, but it does explain a low public service rate. Whether it is the true explanation in Cleveland's case does not appear clearly in the published literature upon it. Either municipal ownership or municipal control of rates might be used to correct any injustice here and there are many arguments for the latter. It may very well be true that Cleveland is not paying enough for its public light; that it is securing public advantage at a greater private cost. Comparison with other rates from private companies in Massachusetts and elsewhere suggest this. Comparison with the cost of electric light in the Chicago and other municipal plants may better be said to show this than to show excessive cost in Chicago.

In fact, the history of electric lighting in Chicago is really an argument in favor of municipal ownership. The constant and great reduction in prices per lamp per year charged by private companies is the most evident argument, but the detailed reports of the municipal electrician and the expert accountants present many more. The effect of the allowances for depreciation and interest are clearly shown in Mr. Adams's paper above referred to. A new plant growing from year to year has an increasing allowance for depreciation and interest, one which is purchased complete has a decreasing allowance for depreciation. The periods of existence of the parts of electric light plants in Massachusetts are averaged at twenty years. No comparisons of total costs are really fair which are not spread over at least this length of time. Nothing shows this clearer than the history of the Chicago plant, and the study of Mr. Adams's tables for plants complete will throw much light upon this point also.

The futility of many of the arguments presented is exemplified by the few mentioned. Because they lack the strength which they would have if they were applicable to the case in hand, they weaken the strong argument presented by the low rate for street lights enjoyed by the city, which it would be very difficult if not impossible to equal in a municipal plant. The question of injustice to private consumers of light is one which it may be possible to raise, but it should be considered independently of the question of municipal ownership.

There seems to be a line in Mr. Adams's data leading to the restriction of municipal plants to public service, the city furnishing its own light and leaving the private service to private enterprise. There is no choice in Illinois, municipal plants being so restricted by law.

A CASE IN ENGINEERING ETHICS.

In the construction of the new Troy, N. Y., waterworks tunnel there arose a question upon which there is evidently much room for difference of opinion among competent and experienced engineers. The engineer in charge of the work, Prof. W. G. Raymond, reported that part of the tunnel would require lining and part would not, the rock through which it is cut being Hudson river shale, much of which is durable when not exposed to the weather and nearly all of which will ultimately disintegrate when subjected to sun, frost and rain. He asked for consultation, but the Municipal Improvement Commission paid no attention to the matter until the contractor asked for permission to line the entire tunnel with concrete. The commission then obtained reports from three engineers and decided to line the entire tunnel with concrete, notwithstanding the differences in opinion as to the necessity of any lining in part of the tunnel and as to the material with which it should be lined, one of the engineers condemning the use of concrete and recommending iron pipe lining. This action was all taken without reference to Mr. Raymond and he was then instructed to prepare the plans for the work as ordered.

Such action as this by boards and city councils is not unheard of, but it is usually taken by men who consider the engineer as simply a clerk or superintendent whose duties are to carry out orders, and that their position carries with it and transfers to them all the engineering ability which is necessary to decide the strictly technical questions which arise as well as to issue the orders for the work. Too often this position is correct so far as the capabilities of their engineer are concerned. Independent advice is sometimes sought from engineers of more or less standing in the community or the nation in the same manner as at Troy. It is seldom, however, that this happens in cities as large and presumably as well advanced in knowledge of the conduct of public works as Troy, or that it happens with so competent an engineer in charge as Professor Raymond.

The ordinary engineer on the smaller

work accepts the relegation of his office to the grade of a clerkship and carries out his orders to the best of his ability. An engineer accustomed to decide professional questions for his commission has a choice of three principal reasons for such action, one that the commission has lost confidence in his ability as a technical adviser and takes this method of telling him so, one that it is in its ignorance assuming, in the manner above referred to, duties belonging to him, and the third that undue influence has been brought to bear. What reason or combination of reasons to assign and what action to take can only be decided by the engineer himself; if the first reason resignation is evidently the proper course, if the second or third it may or may not be. The true reason does not appear in the published accounts of the case at Troy, though the indications are that the second one named is the one to be assigned. Professor Raymond is generally commended for his action in resigning and his high standing as a competent engineer is strengthened.

Another ethical question is that regarding the acceptance of employment by the consulting engineers in such cases. Fortunately engineers are not bound by any such code on consultation as physicians and hard knots can be readily cut. In fact, the frequent occurrence of independent consultations and of second and even third commissions, accepted by the best engineers, shows that the field is open and there is no limitation generally recognized in the profession. The matter of courtesy to the engineer in charge and the manner of showing it is one which is of an importance which is fully recognized by many individuals, some carrying its observance to an excess. Here, too, decision can only be made with full knowledge of the facts in a particular case, and no one who is unfamiliar with them should pass judgment upon the action of his professional colleagues.

TWO COMING MUNICIPAL CONVENTIONS.

Special attention is again called to the meetings of two associations composed mainly of municipal officials, which will be held in October. The seventh annual convention of the League of American Municipalities will be held at Baltimore, Md., Oct. 7, 8 and 9, and the tenth annual convention of the American Society of Municipal Improvements will be held in Indianapolis, Ind., Oct. 20, 21 and 22. The programs to be followed by the conventions will be found elsewhere in this magazine, so far as they have been completed at the time this number goes to press.

The American Society of Municipal Improvements is the older organization. It was started by Mayors and Boards of Public Works for the interchange of information and ideas about the various improvements which cities find themselves obliged to make. The charter members felt the need of some method of securing an interchange of ideas, and the continued and pronounced success of the society is evidence that it was and is needed. It has often been said that the volumes of proceedings of conventions of the A. S. M. I. form the most valuable collection of literature upon the subject of municipal improvements which has ever been made.

An examination of the volumes will show that the society has from the first confined itself strictly to administrative problems in the department of public works, parks, sanitation, etc., having to do with the improvement of material conditions. This action of the society was wise, for the entire field of municipal government is too large for any one major any one society to cover in any but a superficial way, and this society is anything but superficial in its methods of work. That the three days of each convention are well filled is shown by the size of each volume of proceedings, the quality of papers and of discussions.

Our readers who are engaged regularly or occasionally in municipal work will find time and money well spent in attending the Indianapolis convention and securing membership in the society. The city of Indianapolis will present special attractions in addition to the valuable sessions of the convention.

The League of American Municipalities was formed three years later than its sister society and is composed mainly of the executive and legislative members of the city government. The difference in the methods of treatment of subjects common to both the societies is indicated somewhat by the method of statement of the subjects of papers and there are subjects peculiar to each society. The L. A. M. has had its periods of difficulty on account of methods of management, but seems now to have fallen into better hands and it certainly offers this year a very attractive program to those who are interested in municipal problems as con-

sidered from the standpoint of its members. Baltimore will vie with Indianapolis in its offerings to the visiting municipal officials. The Secretary of this Society is furnishing much assistance to its members by way of information published in its occasional bulletins, as well as in its annual volume of proceedings.

There has been an occasional suggestion that these two societies were rivals and were not interested in one another's success, but these suggestions have no basis in fact at the present time.

The methods and membership of the two societies may be said in a sense to have crystallized and each has taken a form which leaves plenty of room for the other and each has taken up material and men which do not find their needs met by the other. There are, to be sure, some who might find place in both societies, because their office or their interest would lead them to take part in both classes of discussion. There are also some papers at each convention which would be of interest to some members in the other society. The proposition that all the societies considering public improvement questions should have common time and place of meeting ought to have special interests for these two societies. It would not be desirable to combine the two societies into one. Their history shows this, and no program could be made large enough to contain all the work of the two nor could it be made interesting enough to all to hold the members to all the sessions.

A common time and place of meeting, without further connection, steers clear of the objectionable features of a combination, retains the present valuable organizations and their programs, and adds the advantages of the opportunities afforded members of each organization to listen to special papers before the other, not to mention others which have been considered elsewhere.

The league meets this year the first Wednesday in October and the A. S. M. I. the third Wednesday. It is suggested that each set its date for next year on the second Wednesday in October, and, since both societies will probably wish to meet in St. Louis in 1904, an entirely informal trial of the advantages of contemporaneous conventions can be made.

THE QUESTION DEPARTMENT

INFORMATION ABOUT SAND BRICK.

Will you kindly inform me where I can learn something about sand brick? I should like to ascertain what their quality is as compared with clay brick, and I should like to know something of the economy of manufacture.

J. M. SEVERENS,
Montevideo, Minn.

The methods of manufacture and the strength of sand brick are considered in the following articles in Municipal Engineering: Vol. xxiv, pp. 218 and 457; vol. xxv, p. 37. These articles are upon brick made of lime and sand. Some information upon brick made of cement and sand will be found in vol. xxi, p. 404; vol. xxii, p. 92; and vol. xxv, p. 175.

In this number will be found a review of a valuable article upon sand brick which appeared in the last volume of proceedings of the American Ceramic Society. It is by S. V. Peppel and copies of the entire article can be obtained for 50 cents. The only book on the subject is "Silico-Calcareous Sandstones" ($1), by Ernest Stoffler, a review of which will be found in vol. xxv, p. 197. Municipal Engineering Company can supply any book desired.

COLORS FOR CEMENT WORK—CEMENT TUBS FOR HOT WATER.

1. Is there any kind of coloring matter that will not fade in cement blocks? 2. Can I make a tub that will stand hot water? The tub is filled with cold water and then steamed to a boil. I made one two years ago and it cracked badly.

R. B. C., Walkerton, Ont.

1. The mineral colors made of iron oxides and ochres should not fade. These include nearly all the colors ordinarily used. Cement work does not reach its permanent color until thor-

oughly set and dried out, processes taking some time. The change in color which takes place during this time can not strictly be called fading. Sometimes carelessness in mixing the coloring matter with cement does not show until the gradual drying out brings the permanent colors and shows the irregularity in mixing in the shape of mottled or irregular distribution of tints.

2. Can any of the practical cement workers among our readers tell how to make the tub? The considerable expansion in the concrete on account of the rise in temperature due to the heating of the water is difficult to manage without straining the slabs of concrete and producing cracks. Those who have been able to overcome the difficulties may be willing to share their knowledge with others. If so, we will publish their information if it is sent to us for that purpose.

HOW TO MAKE HOLLOW CEMENT BLOCKS.

I would like to know the method of making cement blocks for house building.
G. P., Mount Forest, Ont.

There are two classes of methods of making cement blocks, whether hollow or solid. One class uses mixtures of cement and sand or gravel and possibly stone chips, made with only enough water to complete the process of crystallization in the setting of the cement. The other class uses enough water to make the mixture flow with considerable readiness into all parts of the mold.

For the first process a large number of machines have been invented. The first such machines were made over twenty years ago, patents having been granted in England for them. Very recently, owing to the rapid extension in the use of cement in this country, there has been a large increase in the number of patents on such machines, beginning with the H. S. Palmer machine.

For the second process several methods and forms of apparatus have been devised.

The most prominent representatives of both classes are represented in our advertising columns, to which reference should be made, as well as to the "Business Directory" under the headings "Cement Construction," "Cement Machinery," "Concrete Blocks," and "Concrete Work."

Several articles upon the subject have appeared in this magazine. Among them may be mentioned: "Concrete Building Blocks," vol. xxii, pp. 13. 161, 163; "Forms for Cement Blocks," vol. xxiii, p. 112; "Patents on Hollow Concrete Building Blocks," vol. xxiv, p. 436; "Machines and Methods for Making Hollow Building Blocks," vol. xxiv, pp. 192, 279, 356. Descriptions of various methods of making blocks and of the machinery or other apparatus for making them will also be found in vol. xxiii, p. 392; vol. xxiv, pp. 234, 393, 455, 457, 482; vol. xxv, pp. 53, 54, 129.

A SUCCESSFUL DESIGN FOR CONCRETE CURB.

Please find inclosed the drawings of a form of cement curb which I have set in this city and find as good as when it was put in. The material of which the curb is made is a concrete of Portland cement reinforced with twisted wire. All sizes can be made and round corners on the same style. I claim that this curb will last longer because the wheels will not rub the top of the curb. I would like to know what others think of this form of curb.
PERCY LUNER,
Clarksburg, W. Va.

The drawing shows a cross section of the curb which has a vertical side next the sidewalk. On the street pavement side the curb is also vertical up to the surface of the pavement, the thickness of concrete being 6 inches. At the top the thickness is 4 inches, thus giving a slope to the curb from gutter to top of 2 inches. If the gutter is 6 inches deep this is a slope of 2 inches in 6. If any of our readers have tried curbs of similar form we hope to hear from them whether they have proved satisfactory or not, and the exact form and method of construction.

MARBLE DUST ON SIDEWALKS.

Can you give me information in regard to screening marble dust on sidewalks? Is there any benefit in doing so?
G. W. DENNY, Marine City, Mich.

It is assumed that the question refers to the sifting of marble dust on the surface in finishing cement walks. Can our readers give any reports of experience with it? One objection is the white color. A material objection to cement walks is the light color and the glare of light. The marble dust would intensify this until it wore off, when the color would not be uniform, since the wear would not be uniform. If the top coat is mixed with the right amount of water, no addition of dry material is necessary in finishing. If the mixture is too wet, the addition of neat cement sprinkled on dry is not satisfactory as

hair cracks are likely to form and the surface is likely to flake off. A mixture of cement and sand or cement and marble dust gives better results. The same mixture as that already laid is the best as the walk will then wear uniform in color.

NEW PORTLAND CEMENT FACTORIES.

We would like to have a list of the names of cement mills which have begun operations since the last edition of the "Directory of American Cement Industries and Handbook for Cement Users" was issued.

V. H. PARKE & SON COMPANY,
Decatur, Ill.

Besides the new mills put in operation by companies reported as making cement in the "Directory of American Cement Industries and Handbook for Cement Users" ($5), on account of enlargement of their capacity, the following is a list of the plants put in operation since the "Directory" was issued, by companies new to the trade. All but one of these were reported in the last edition of the "Directory" as being under construction:

Pacific Portland Cement Co., Suisun, Cal., and Claus Spreckles Building, San Francisco, Cal.

Alta Portland Cement Co., Rushsylvania, O.

Great Northern Cement Co., Baldwin, Mich.

Hecla Cement & Coal Co., Bay City, Mich.

Portland Cement Co., Portland, Colo.

Florence Portland Cement Co., Florence, Colo.

Ironton Portland Cement Co., Ironton, O.

St. Louis Portland Cement Co., St. Louis, Mo.

Edison Portland Cement Co., Stewartsville, N. J.

Hudson Portland Cement Co., Hudson, N. Y.

Imperial Portland Cement Co., Owen Sound, Ont.

Hanover Portland Cement Co., Hanover, Ont.

Sun Portland Cement Co., Owen Sound, Ont.

National Portland Cement Co., Durham, Ont.

Alsen's American Portland Cement Works Co., West Camp, N. Y.

Aetna Portland Cement Co., Fenton, Mich.

Egyptian Portland Cement Co., Fenton, Mich.

Newaygo Portland Cement Co., Newaygo, Mich.

Illinois Hydraulic Cement Mfg. Co., Utica, Ill. (natural).

Struthers Furnace Co., Struthers, O. (slag).

The following are said to be under construction, and possibly some of them have recently begun manufacturing cement:

Midland Portland Cement Co., Bedford, Ind. Offices, Law Building, Indianapolis, Ind.

Toledo Portland Cement Co., Manchester, Mich.

Mohawk Cement Co., Warners, N. Y.

International Portland Cement Co., Hull, Ont.

Elk Rapids Portland Cement Co., Elk Rapids, Mich.

Apollo Cement Mfg. Co., Apollo, Pa.

Penn-Allen Cement Co., Allentown, Pa.

Southern States Portland Cement Co., Atlanta and Rockmart, Ga.

Farwell Portland Cement Co., Farwell, Mich.

J. H. Gehr & Co., Waynesboro, Pa.

National Portland Cement Co., Martin's Creek, Pa.

Alma Cement Co., Wellston, O.

Raven Lake Portland Cement Co., Raven Lake, Ont.

Superior Portland Cement Co., Orangeville, Ont.

Ontario Portland Cement Co., Blue Lake, Ont.

Colonial Portland Cement Co., Wiarton, Ont.

Central Cement Co., Coplay, Pa.

Buckhorn Cement Co., Manheim, W. Va.

Standard Portland Cement Co., Napa Junction, Cal.

Empire Portland Cement Co., Warners, N. Y.

Marksboro Portland Cement Co., Marksboro, N. J.

Belleville Portland Cement Co., Belleville, Ont.

COST OF BRIDGES.

Will you please quote me the present prices on structural steel, or the price per pound of truss bridges of from 50 to 100 feet span?

C. C. HUNTINGTON,
County Surveyor, Eureka, Kas.

Steel of the shapes used in bridges is now quoted at 1.75 to 2 cents a pound at the mill. Prices in Kansas at points not on the Missouri River would probably be 1-3 to 1-2 cent higher. Recent contracts indicate that bridges of the sizes suggested would cost 4 cents a pound or slightly more, plus the transportation from the works to the place of erection.

About ½ cent of this cost may be assigned to the shop work, though it will evidently vary somewhat with the kind and amount of work.

HOW TO MAKE A RESERVOIR WATER TIGHT.

We have recently constructed a 75,000 gallon brick and cement reservoir. The diameter of this reservoir is forty feet and the depth is eight feet. The walls are of hard burned arch brick, laid in cement. Their thickness from the bottom half way up is fourteen inches, the remainder being nine inches. The bottom is of concrete. The reservoir is built in ground which is thoroughly saturated with water and is full of springs. We struck a spring in the bottom of the reservoir which gave considerable water, but an analysis proves it not fit for drinking purposes. The outward pressure from this spring bursted the concrete bottom and let the water into the reservoir. The water surrounding the reservoir comes through the brick and cement wall. It is our desire to make this reservoir entirely water-tight. Can you not suggest some scheme for doing this?

RICHARD W. MARCHANT, Jr.,
Roland Park, Md.

This is a difficult problem and some of our readers may be willing to send us descriptions of devices which they have used under similar conditions. Reference may be made to Municipal Engineering, vol. xxiii, p. 179, for suggestions on making the side walls tight. It would probably be necessary in this case to dig down on the outside and plaster the entire outside of the wall with a thick coating of cement mortar, made with one part of cement to one-half to one part of sand. Another suggestion is to the effect that a brick lining be put into the tank, say two inches from the present inner surface, the space between to be filled with the cement mortar. This would reduce the diameter of the reservoir about one foot. For suggestions on making the bottom water-tight reference may be made to Municipal Ergineering, vol. xxi, p. 230, and to the "Directory of American Cement Industries and Handbook for Cement Users" ($5). There is evidently considerable pressure from the spring and a heavy floor will be necessary. Perhaps it should be made in an inverted dome shape, and a few steel bars properly placed in the concrete would strengthen it with some saving of concrete. If the pressure of the water can be kept off of the bottom until it has thoroughly set, there should be no great trouble in making it strong and waterproof. Pumping from a sump would keep the water down. It may be possible to lay drain pipes from the springs to a sump outside the well area and pump from it. This would obviate the difficulty of plugging a sump located within the area of the bottom of the reservoir.

PORTLAND CEMENT MANUFACTURE IN CUBA.

Will you kindly advise us whether there are any companies in Cuba which manufacture Portland cement?

THE OSBORN ENGINEERING CO.,
Cleveland, O.

The "Directory of American Cement Industries and Handbook for Cement Users" ($5) mentions L'Almendares as a Portland cement factory at Havana. The central office of the company is in Paris, France. This seems to be the only Portland cement factory in operation in Cuba.

INFORMATION ABOUT VITRIFIED PIPE WATER CONDUITS.

Some time ago you gave a photograph and some written explanation concerning the use of vitrified pipe as a water conduit between two reservoirs in the state of Connecticut. Would you please refer me to the number in which it will be found?

CALEB TANNER,
City Engineer, Provo, Utah.

The particular article referred to is in Municipal Engineering, vol. xx, p. 89. Other articles on the use of vitrified pipe for water conduits will be found in vol. xx, pp. 76, 151 and 355 and in vol. xxiv, p. 234. A picture of the pipe line will be found in the advertisement of the American Sewer Pipe Company in several recent numbers in this magazine.

IRON PIPE LAYING IN ROCK EXCAVATION.

Will you please give me information relative to the proper depth of sand that should be placed under 4-inch cast iron gas pipe laid in trench excavated in rock? Can you refer me to any authority on this subject?

JULIUS F. FREHSEE,
City Engineer, Lockport, N. Y.

Fanning, in his "Treatise on Hydraulics and Water Supply Engineering" ($5), recommends a layer of gravel well tamped in the bottom of a trench in rock as a foundation for pipe. Turneaure, in his "Public Water Supplies" ($5), recommends 3 to 6 inches of sand as the foundation for cast-iron pipe laid in a rock excavation. Except for the weight of the water and the difference in weight of pipe, the conditions for water and gas

pipe are the same. Gas pipe will be weaker to stand outside pressure than water pipe if in the ordinary low pressure distribution lines. The principle of the recommendations is that the weight of the pipe shall not rest on the bells, thus concentrating the weight of the pipe on single points, which might also carry some weight of the earth resting on top of the pipe. This condition would also put some bending strain on the pipe length, the two effects adding strains for which pipe and bell were not designed.

TAR OR BITUMINOUS MACADAM FOR STEEP STREETS.

1. Do you know of a process of applying tar to old macadam? If so explain it in your magazine and state its probable cost.

2. We have several excessive grades in our streets. At these points the stones loosen and must be raked up. Would you advise tarred macadam in this case?

3. What grade of tar is used for this kind of work and where is it likely to be found?

JAMES HAMILTON,
City Engineer, Chester, S. C.

Tar could be applied to old macadam but the result would probably not be satisfactory. The office of the tar is to bind the stones of the macadam together and to make the street waterproof. The voids in an old macadam street, especially near the surface, are already filled with the dust from the wear of the stone, so that but little of the tar applied on the surface could find its way in. Any good effect of the application of the tar would therefore be short lived. This has been the experience in England, if one may judge from such indefinite reports upon experiments of this nature as have appeared.

2. The writer's observation of streets with grades up to about 14 per cent. leads to the conclusion that a well-constructed bituminous macadam pavement is among the best, perhaps the very best, for steep streets. It seems to be no more slippery than ordinary macadam and is not washed away by the water draining down the roadway.

3. Pure coal tar of fixed grade or temperature of refining is necessary. For Warren's bituminous macadam the Puritan brand of coal tar is used, the grade being fixed for the conditions of the locality in which the street is laid. Warren Brothers company manufacture this brand with refineries in Boston, Washington and Nashville, Tenn. Specifications for tar macadam streets in Hamilton require pure coal tar free from all foreign substances, containing not more than 5 per cent. of water and not less than 55 per cent. of pitch. Warren Chemical company's tar is said to be the best. In Toronto the tar and pitch are mixed in equal parts; the tar being quite thick at 70 degrees F. with specific gravity of 1.2, refined at 250 degrees F. and entirely free from water and lighter hydro-carbons; the pitch being tenacious and not relatively brittle at ordinary temperatures, insoluble in water, 1.15 specific gravity, with melting point not less than 220 degrees F. In Geneva, N. Y., the Cambria Steel company's coal gas tar was used as possessing the necessary physical proportion. The quality of the tar and pitch is of great importance.

The city engineer of Duluth, Minn., made an investigation of the various methods of contracting tar and bituminous macadam pavements, and reported upon them in 1902. A short statement of his conclusions will be found in Municipal Engineering, vol. xxv., p. 202, in a review of his annual report. He emphasizes the necessity of the proper grade of bitumen and decides in favor of the scientific design and careful manufacture of Warren's bituminous macadam and of the materials of which it is constructed.

ARTICLES ON ASPHALT PAVEMENTS.

I should like to know what numbers of your journal have special articles on asphalt pavements. W. J. JONES, JR.,
Lafayette, Ind.

There are more than 450 articles on asphalt paving in the 24 volumes of Municipal Engineering. A special list of articles on working asphalt will be found in vol. xxi, p. 153, one on cost and durability of asphalt pavements in vol. xxiii, p. 100, and one on asphalt and asphalt paving in vol. xxiv, 275. The following are a few which may be of special value to our correspondent, collected from the last ten volumes: In vol. xxiv, "American Asphalt Rock for Pavements;" p. 212, "Cost of Laying Asphalt Surface," p. 198; in vol. xxiii, "Surfacing an Old Brick Street with Asphalt," p. 177, "Maintenance of Asphalt Pavements," p. 10; in vol. xxii, "Asphalt Paving Under Municipal Management," p. 144, "Municipal Asphalt Plants," p. 150, "Winnipeg's Municipal Asphalt Plant," p. 176, "Binder course of Asphalt Pavement," p. 86; in vol. xxi,

"Asphalt Inquiries from Milwaukee," p. 249, "Asphalt Pavements for Southern Cities," p. 156, "Natural and Artificial Mixtures for Asphalt Pavements," p. 330; in vol. xx, "Repairs of Asphalt Pavements in Buffalo, p. 97; in vol. xix, "Recent Paving Practice in Lafayette," p. 390, "The Construction of Asphalt Pavements," p. 179, "The Value of Chemical Tests of Asphalt Mixtures," p. 182; in vol. xviii, "Failures in Asphalt Pavements and Their Causes," p. 18, "Asphalt for Small Cities," p. 42; in vol. xvii, "The Life of Pavements," p. 272, "Cost of Asphalt Repairs," p. 14, "Street Grades and Cross-Sections in Asphalt and Cement," p. 190; in vol. xvi, "Data on Asphalt Pavements in American Cities," pp. 298 and 319, "Expansion and Contraction of Asphalt Pavements," p. 333; in vol. xv, "Theory and Practice of Asphalt Mixtures," p. 364 and "A Study of Paving Materials," p. 353.

BOOKS ON LAND DRAINAGE.

Please give me prices of books on land drainage.

J. B. BERTOLET.
Leaf River, Kas.

Mr. Elliott has recently published a new edition of his book "Practical Farm Drainage" ($1) which has been a standard for many years. His new book, "Engineering for Land Drainage" ($1.50), treats the subject in a larger way and is even more satisfactory than the earlier book. Waring's "Drainage for Profit and Drainage for Health" ($1.50) is another. Two English books are Denton's "Agricultural Drainage" ($1) and French's "Farm Drainage." The first named book by Mr. Elliott is reviewed in this number of Municipal Engineering and the other was reviewed in the September number.

SPECIFICATIONS FOR LAYING PIPE FOR STORM SEWERS.

Will you kindly inform me where I can get specifications for inspection and laying of terra cotta pipe from 12 to 36 inches in diameter for the purpose of carrying off surface water in streets?

S. P. A., Wilmington, N. C.

In Municipal Engineering, vol. xi, p. 35, will be found a full description of methods of laying sewer pipe which may be directly applicable in this case. Folwell's "Sewerage" ($3) gives full specifications for sewer pipe and laying. It may be that the strict specifications referred to will be necessary, but ordinarily the soil in which the drain pipes are laid is such that tightness of joints is not an essential. In such cases there is no need of gaskets nor of bevel joints. Careful laying to straight grade line is very desirable even if there is plenty of fall in the line, and the pipe should be well bedded and carefully filled over. Accuracy of form of pipe and entire freedom from defects in surfaces and in bells is sometimes not demanded for drain pipes, but this is generally a mistaken policy. Breaks in bells cannot be satisfactorily closed with cement, and if the lines ever run under pressure or there is much ground water, there is danger of washing the earth from the trench into the sewer. Ordinarily, therefore, the only point on which there should be any departure from the best sewer specifications is in the making of joints, and, unless a part of the office of the sewer is to act as a subsurface drain they should be laid in cement with reasonable care and neatness.

Most city engineers' specifications for storm water sewers of vitrified pipe are the same as for sanitary or combined sewers of the same material.

INFORMATION ABOUT SEWAGE DISPOSAL.

Where can the most and best information be obtained concerning sewage disposal where there is no room for filter beds, where the sludge must be consumed or removed, in a district of 2,500 or 3,000 inhabitants?

A. CASSIL,
City Engineer, Mt. Vernon, O.

If the sewage must be purified to the extent possible in filter beds, it will be necessary to lift it to the height necessary to give room for the filters. This can be done by the air-lift or an electric pump operated from a distance or automatically or otherwise in several ways requiring only occasional attention. If the purification attainable in the septic tank is sufficient, it is only necessary to keep the outlet from the tank (its water surface) a few inches above the highest stage of water in the stream receiving the effluent, thus losing but little of the available fall. The solid matters are largely converted into liquids and gas in the tank and the small remaining amount can be pumped out with a hand pump without stopping the action of the tank, with very fair results. The writer designed a tank of this sort which was constructed in 1891 and has worked very satisfactorily ever since, requiring cleansing not more than once or twice a year. The sludge is in small quantity and comparatively inoffensive, so that it is run over

any unoccupied bit of convenient ground, dried, and may be turned under.

Many articles on all the different forms of sewage disposal and practical applications thereof and on methods of lifting sewage will be found in the volumes of Municipal Engineering. A list of books on the subject will be found in vol. xxiv, p. 363. They all describe methods of treating sludge.

CONSTRUCTION OF RACE TRACKS.

Can you refer me to some book or publication on proper form and manner of construction of race tracks, giving grades admissible, etc.? SUBSCRIBER,
Charlevoix, Mich.

In addition to the information given in Municipal Engineering, vol. xxiii, p. 29, and the detail given in the articles there referred to Baker's "Roads and Pavements" ($5), may be consulted. This book has been issued since the article above referred to was written. It devotes fifteen pages to the subject of race tracks and gives details of form, methods of laying out and of construction. This is the most complete treatment of the subject to be found in any book.

THE DISTINCTION BETWEEN SAND AND GRAVEL.

In a recent contract for concrete the specifications required certain proportions of sand, gravel and cement, with a provision that pit gravel could be used if it contained the proper proportion of sand. A dispute soon arose between the contractor and inspector as to whether certain material offered complied with this requirement, and could only be settled by determining what is sand and what is gravel. The inspector could learn of no custom or authority which would be binding if the case came into court. A similar question might arise where specifications for masonry require coarse sand to be used for mortar. Can Municipal Engineering throw any light on the question where sand ceases to be "fine" and becomes "coarse," or ceases to be "sand" and becomes "gravel," as these terms are applied in specifications for brick or stone masonry or concrete?

In specifications for testing cement it is common to require that the sand used shall pass a screen of 20 meshes per lineal foot and be rejected by one of 30 meshes. Illinois Central specifications for concrete "prefer" sand that will not pass through a screen of 30 meshes. Some sidewalk specifications require gravel not less than ¼-inch in diameter, or sand not exceeding ⅛-inch. Beyond these there are few data to be found.
SUBSCRIBER, ——, Mich.

Byrne in his "Highway Construction" ($5) defines gravel as "an accumulation of small stones which vary in size from a small pea to a walnut, or somewhat larger." This may very well serve as a distinction between gravel and sand. Screens for broken stone are usually circular perforations in metal plates or cylinders down to ⅜ or ¼ inch in diameter. For less sizes the screens are made of wire woven in the form of cloth, with meshes of ¼ inch or less in size. This point of change in screens might be considered the point of change from gravel to sand.

There is, however, another distinction in good materials for engineering work The usual specification for sand requires that it be sharp, having angular corners or edges. Gravel, on the other hand, is rounded. Larger particles of sharp, angular form than those passing the No. 10 or No. 4 screen might be admitted as sand, while rounded particles of the same size might well be classed as gravel, for in the latter case the point of change from gravel to sand is entirely arbitrary and fixed by definition. The Byrne definition, or that made by the change in screens, may not be accepted by all, but it is convenient, especially the screen definition, and is suggested for adoption on that account.

Tillson's "Street Pavements and Paving Materials" ($4) gives a table of percentages of voids determined by H. von Schon in various materials in which the largest size of sand quoted passes a No. 10 and is retained on a No. 20 sieve. Gravel, in the same table, was evidently a mixture of gravel and sand as it runs from 1½ inches to No. 40 screen and no point of change from gravel to sand is fixed.

In Baker's "Roads and Pavements" ($5) is a table of sieve analyses of various gravels in which the distinction between sand and gravel is not drawn. In the text describing the samples of gravel named in the table the presence of fine sand is noted. Mr. Baker's definition of gravel makes no mention of sizes.

There is evidently some room for difference of opinion regarding the exact point of change from gravel to sand in all cases. But if the distinction between gravel as a water-worn, somewhat rounded material and sharp sand is first made without particular reference to difference in size, the remaining distinction between gravel and sand with rounded grains need not be drawn with the utmost exactness. Mr. Byrne's descriptive definition or the point of change from circular to square holes in sieves may

then be admitted as a convenient mode of distinction in the few cases when distinction is necessary. There is some indefiniteness in the point of change of screens, there being, for example, both circular and square ¼-inch screens. It would be a needless refinement, however, to carry the distinction to the last eighth of an inch.

MUNICIPAL MATTERS IN COURT

Decisions by Higher Courts.

Abstracts from Decisions of the Higher Courts.

Assessments—The statute providing for the erection of wooden sidewalks required ten days printed notice of a meeting to consider the improvement or in lieu thereof personal notice. Neither alternative was complied with: Held—There was no such compliance with the statute as would authorize the ctiy to levy a special tax against the abutting real estate.—Trephagen et al. vs. City of South Omaha. 96 N. W. R. (Neb.) 248.

Special Assessment — Statute Void— Massachusetts stat. 1892, p. 444, ch. 402, provides for a special assessment without an equivalent in benefit, and in addition to the proportional part of the general tax. Held—Where the constitution provides that taxes shall be proportional and reasonable, such a statute is void.—White vs. Gore, 67 N. E. R. (Mass.) 359.

Assessment—Estoppel—The complainant had received notice of the contemplated improvement as provided by statute. He had even appeared by attorney and made objections to the assessments. He now seeks to avoid his assessment on the ground that his own petition for the assessment was not drawn with sufficient particularity and that the notice provided for by the statute was not sufficient. Held—The plaintiff having had actual notice, cannot raise this question and that he is estopped to attack his own petition. —Rowe vs. Commissioners of East Orange. 55 Atl. R. (N. J.) 649.

Assessments—Notice—The notice of the hearing of the assessment was indefinite, and the board of equalization did not meet at the time and place specified in the notice. Held—That the statutory requirements must be strictly complied with.—Farmers vs. Hastings et al. 96 N. W. R. (Neb.) 104.

Assessments—Statute valid. Gen. st. 1901, sec. 8,740, creates taxing districts, but does not provide that the assessment levied shall be in exact proportion to the benefit conferred. Held—That the act did not authorize the levying of assessments where no benefit was conferred, but seeks to make as nearly an equitable charge as possible, and that it is constitutional. —Kansas City et al. vs Gibson et al. 72 a street improvement was duly filed. The Pac. R. (Kas.) 222.

ferred by the above statute a petition for

Assessments — Sustaining Objections — Where one objects to the confirmation of an assessment on the ground that the requirements of the law have not been complied with, the burden is upon him to show it. Where it is left to the trial judge to determine the necessity and reasonableness of an improvement, his finding will not be disturbed unless error can be shown.—Wells vs. City of Chicago, 66 N. E. R. (Ill.) 1056.

Improvements—Petition—Construction of H. Starr & Co., Ann. St., p. 149, c. 24, par. 40. Pursuant to the authority conillegal. Held—That the refilling of the old petition, three months and three days ordinance was passed, but was declared after the filing of it the first time, did not give the local board authority to pass another ordinance, for the reason that different people may have become the owners of the property.—Vennum vs. village of Milford. 66 N. E. R. (Ill.) 1,040.

Assessments—Sewer—The plaintiff contested the payment of certain sewer assessments, for the reasons, first, the manner of assessment was not legal; and, second, that the board had not equitably assessed the benefits. Held—The finding

of the lower court was conclusive as to the amount of the assessments and the assessment of benefits. The fact that the amount of the assessment was determined by a charge of so much per front foot did not invalidate the assessment without a showing that that method was unjust and arbitrary.—Bassett vs. City of New Haven, 55 Atl. R. (Conn.), 579.

Assessments—Street Railroad—Plaintiff city at the time it passed the paving ordinance in question knew that the railroad company was bound by contract with the city to pave part of the street. Held—That a judgment of confirmation of the assessment charged to the abutting property-owners of that part of the assessment which should have been paid by the railroad company is fraudulent, that the ordinance is void and consequently the judgments.—City of Chicago vs. Nodeck et al., 67 N. E. R. (Ill.) 39.

Contracts—Eight-hour Labor Provision Invalidated—Plaintiff objected to entry of judgment and order of sale against his property because of non-payment of special assessment, on the ground that the contract for the work provided that the contractor should not "compel or allow" the laborers to work longer than eight hours per day. Held—That by the presence of such restrictions the number of bidders was limited and the competition was not free; that such conditions invalidated the proceedings.—Glover vs. People. 6 N. E. R. (Ill.) 820.

Improvements.—Authority of Council to Make.—The city council is clothed with the power to determine the need for local improvements, their nature, location, etc. Their action in such matters is final and the courts have no right to interfere to prevent the construction of such improvements, unless the council shall unreasonably abuse their discretion or, as the court says, its conduct of business shall be "so unreasonable as to render it void." In this case the discretion was not abuse.—Walker vs. City of Chicago. 67 N. E. R. (Ill.) 370.

Laches. — The grades of the street in question were established under an ordinance passed in 1896. A number of property-owners abutting on that street had been compelled to conform to that line, a sewer had been put in and intersecting streets had been improved. Held, That property-owners were barred by laches from maintaining certiorari not begun until five years after the ordinance was passed. Hopewell et al. vs. Board, etc., Flemington. 55 Atl R. (N. J. L.) 633.

Wholesale Sidewalk Ordinance—Acts 1875, p. 63, sec. 1 (Sidewalk Act), provides that any village may provide by ordinance for the construction of sidewalks. Held, That a village may not by a single ordinance authorize the construction of a number of distinct sidewalks on different streets. Held, also, That where the entire cost of the improvement is to be apportioned to the lot-owners according to their frontage, all of the sidewalk must be completed before the bill of costs may be made out. People ex rel Raymond, etc., vs. Latham et al. 67 N. E. R. (Ill.) 403.

GARBAGE AND STREET CLEANING

St. Louis Garbage Question—Flushing Streets—Washington Street Cleaning.

Garbage Destruction for St. Louis.

The disposition of garbage and city refuse in general in the large cities of the United States and England has been investigated and studied by Benjamin H. Charles, second associate counse lor at St. Louis, Mo. Mr. Charles has reached the conclusion that municipal ownership of a plant in which the garbage and refuse is destroyed by fire is the ideal method for a city the size of St. Louis from the standpoint of economy and sanitation. Mr. Charles's information has been gleaned largely from the works of Charles V. Chapin, superintendent of health, Providence, R. I., and W. Francis Goodrich an English mechanical engineer. He says:

By consulting I find that municipal ownership prevails throughout England

and in many places in this country. Furthermore that incineration has been in use in the former country for the last thirty years, and in this country for the last fifteen. Statistics are shown to prove the satisfactory results of that manner of handling garbage.

It is found that a city's refuse is divided into three classes--asnes, garbage and what I find classified as "other wastes." Of course, St. Louis is at present considering the question of garbage, but as long as there is to be an investigation it seems to me that it would be well to take in the entire problem.

The proportion of garbage to the other two divisions of refuse is about one to seven, so you see these two classes make a bigger item than the garbage when it comes to a question of their disposition. Garbage is given two subdivisions, animal and vegetable.

In reviewing the history of methods for the disposal of garbage it is seen that its disposition has passed through three stages—first, disposal for revenue wherever possible; second, reduction processes with a view to commercial profit; third, incineration.

The first stage is very crude, as it compels men to work under extreme unsanitary conditions, and it is very expensive, as only from 10 to 20 per cent. of the garbage is marketable. This plan is used by the city of Vienna and sorting the garbage has become an industry.

The second stage, or the reduction process, is only practicable for "pure garbage"—that is, the garbage as noted under the third class of city refuse. The reduction is simply cooking the garbage at a low temperature. Of the plants of this character in thirteen of the largest cities in this country seven have closed down or are in the hands of a receiver, two are in the experimental stage and four are still operating.

One great objection to reduction plants is that they constitute a nuisance, as but small success has been met in attempting to prevent obnoxious odors. The cost of maintenance is excessive on account of numerous repairs caused by the acids injuring the machinery.

Only one reduction plant has been found practicable in a city, for it is necessary that a great amount of garbage be utilized or the plant is operated at a loss.

The objections from the standpoint of health in the community where the plant is located have generally resulted in placing it at a distance from the city wherever possible. The long hauls more than outweigh any profit which may be derived in a commercial way.

Montreal was the first large city to erect a garbage crematory on this continent. Pittsburg, Allegheny and Wheeling soon followed suit, and these plants have been in operation about fifteen years. English cities took up this method more than thirty years ago, and now there are about 200 municipalities, including the sanitary districts, in both London and Liverpool, which operate crematories.

The advantages of this modern system for the disposal of garbage are manifold. In the first place, a crematory disposes of all three classes of city refuse, ashes, other wastes and garbage, by subjecting them to a heat of 2,000 degrees or more, Fahrenheit.

Inventions have been made of machinery from time to time, so that there is no odor or other objectionable features connected with the plant. For this reason the question of the location of one or more plants of this character is a minor one.

Instances of this are found in many of the English cities. Leeds operates four plants, Bradford two, while Liverpool, whose population is about the same as that of St. Louis, maintains three crematories.

Various uses are made of the energy resulting from the burning of the garbage. Boilers are attached and the steam is used to run electric plants, stone-crushing machinery, pumping sewage, and there is one case where an English town operates a trolly line by the motive power created in this way.

In England it has been found that the heat equivalent of garbage is from one-fourth to one-seventh of that of hard coal. This fact shows that incineration is by far the most economical method in the opinion of authorities on the subject.

Another advantage is the ash and clinker resulting from the fire. Because of the extreme heat, the clinkers become very hard. The city of Toronto makes country roads out of them, and in many of the cities of England the clinkers are used for the foundation of paved streets.

Of the original ashes which go to make up the first class of a city's refuse there is nearly 20 per cent coal. This is proven by the experiment made by the authorities in New York city in 1897. During that year 8,000,000 loads of ashes were analyzed and 20 per cent. coal was recovered.

Cleaning Asphalt Streets by Flushing.

The superintendent of street cleaning, in Washington, D. C., Mr. Warner Stutler, recently called the attention of Commissioner West to the fact that when the contract for street sweeping and flushing in the city of Washington was let the area to be flushed was materially cut down because of the possible injury to asphalt. Col. John Biddle, engineer commissioner, forwarded to Commissioner West, Sept. 16, a report from C. B. Hunt, engineer of highways, and a statement from Capt. H. C. Newcomer, assistant to the engineer commissioner.

In his report Mr. Hunt, engineer of highways, says:

A definite statement as to the effect of the flushing already done under contract cannot be made. It is not believed that flushing a roadway which has a good drainage grade without depressions which impound water is to such a degree injurious to the pavement as to contraindicate such flushing, provided the same is found to be in any way an advantageous method of cleaning the pavement. In other words, under such conditions, it is not thought that objections to the wetting of the pavements should relatively outweigh any known advantage in the cleaning of streets by flushing.

In the case of pavements which, on account of defective surface conditions, impound water, the objection to flushing would become pronounced to such a degree that the advantages of the cleaning by this method might not overcome the disadvantages which would result from the increased deterioration in the pavement.

Unless there are good reasons for preferring this method of cleaning streets, and unless this method is applied to roadway surfaces favorably constituted as above described, it is the belief of this office that the flushing method should not be preferred since the known liability of asphalt to deterioration under exposure to moisture would indicate that where no objectionable results are noted in the flushing treatment the best that can be said is that the damage has not been proven.

Capt. Newcomer approved this report and forwarded it to Col. Biddle, with the following statement:

The amount of damage to asphalt pavement caused by flushing cannot be precisely determined. Years of experience would be necessary to arrive at even a roughly approximate estimate. It is a pertinent fact that in St. Louis, where a great deal of dirt is brought on the asphalt streets from the large area of unpaved thoroughfares, so that the streets are profusely sprinkled to lay the dust, the life of asphalt pavement is given by the city officials as about five years. In most other cities it is given at about ten to twelve years, while in Washington the average runs from fifteen to twenty years.

One of the principal reasons assigned for this remarkably short life of asphalt pavements in St. Louis is the fact of their being kept wet so much of the time. It is by no means expected that the proposed flushing would shorten the life of our pavements to the same serious extent, but, on the other hand, there can be no doubt that some deterioration will result. Unfortunately at present this must be said to be of indeterminate amount. It should be understood, however, that the policy of flushing the pavements will entail an increased burden in the cost of their maintenance, which will offset to a greater or less extent the advantages of flushing as a method of cleaning.

The engineer commissioner has approved both these statements, and in commenting upon the subject says:

It is impossible to tell within this short time, and it is difficult to tell at any time, how much damage will be done asphalt pavements by flushing. There are many causes that lead to the deterioration of such pavements. At the same time, it is known that asphalt is much affected by water—that being probably the principal reason of its deterioration—and there can be no doubt that it will be affected in the older pavements by flushing.

The amount to be flushed will be about 300,000 square yards. The original cost of this pavement was $1.80 per square yard, making the total cost $540,000. The average life of the best of these pavements is about eighteen years, which would make the cost of the pavement $30,000 per year. In addition to this, the average cost of maintaining the pavement in good repair is about 2 cents per square yard per year, the yearly cost of repairs for this amount of pavement averaging about $6,000. This makes a total of $35,000 a year, which these 300,000 square yards of pavement would represent.

If the flushing shortened the life of the pavement from two to three years the cost to the District would be from $4,000 to $6,000 a year. If the cleaning by flushing is that much more economical or that much more advantageous to the District, the money is well spent.

In the newer pavements we are using an asphalt that is considered to be less acted upon by water, but this is not in the section where the flushing is being done.

It is recommended that the superintendent of the street cleaning department submit his estimates for this year, and that the whole matter be explained to congress, when the estimates are submitted. Of course, the above estimate is very general, and the figures may have to be modified after further experience.

Street Cleaning Methods in Washington, D. C.

Estimates of appropriations needed for the street cleaning, garbage and ash collection services for the next fiscal year were submitted, September 9, to the Commissioners of the District of Columbia, by Warner Stutler, superintendent of the street cleaning department. He asks for a total of $411,050; an increase of $63,766.25 over the current year. This increase includes $35,000 asked for the extension of the ash collection service to hotels, apartment houses and business establishments, and $7,500 for the erection of a combined stable, repair shop and storage building. Mr. Stutler again asks for the transfer of all the members of the office and inspection force from the per diem list to the annual roll. Regarding the increase for sprinkling, sweeping and cleaning streets, avenues, alleys and suburban streets, Mr. Stutler says:

For the fiscal year 1904 an estimate of $205,000 was submitted for street cleaning. Congress, however, appropriated but $190,000 for this purpose, the same amount that had been allowed for 1903. This notwithstanding the fact that the area to be cleaned during the current year is 8 per cent. greater than that of last year, due to the addition of newly paved streets, the opening of public alleys and the grading of new streets.

Because of the insufficiency of the appropriation for 1903 we were obliged to suspend work on all classes of street cleaning for thirty days during the last half of the year, and also to dispense with the services of ten of the hand laborers, in order that a deficiency might not be created. By dispensing with these laborers the daily area cleaned by hand was reduced to the extent of the work previously performed by them, and said area was added to the machine sweeping schedules. The result of this was that some of the streets that had theretofore been swept by machine three times per week were swept but twice, and many of those that had been swept twice were given but one sweeping per week. During the current year the same conditions will obtain and for like reasons.

The estimated increase of $50,000 for street cleaning is made up as follows: $10,000 to meet the 8 per cent. increase in newly paved streets, etc., during the current year, $15,000 for the further 8 per cent. increase in area during 1905, and $5,000 for the 25,000,000 square yards of streets to be flushed.

On June 30 last the contracts on all classes of street cleaning expired. In the early part of that month the commissioners entered into contracts for three years from July 1, 1903, for machine sweeping or flushing at 16 13-16 cents per 1,000 square yards, alley cleaning at 35 cents per 1,000 square yards, and unimproved street cleaning at $64 per day. While it is true that the present machine sweeping rate is less than the old contract price of 18 cents per 1,000 square yards, yet this decreased rate is offset by the increase in the alley cleaning rate from 32½ cents to 35 cents per 1,000 square yards, and also by reason of the increase in the cost of hand cleaning from 15.4 cents in 1902 to about 17 cents per 1,000 square yards in 1903, due to the increase last year in the laborers' pay from $1.25 to $1.50 per diem.

The specifications for cleaning paved strets and avenues by machine, upon which bids were asked last June, contained a provision that the work should be done either by sweeping or flushing, the area to be cleaned by the latter method to approximate 25,000,000 square yards per annum. The lowest bidder for cleaning by the two processes was, as before stated, 16 13-16 cents per 1,000 square yards for a period of three years, and this was accepted. Before the contract was signed, however, the question was raised as to what effect flushing would have on asphalt, and, by agreement between the commissioners and the contractors, a further provision was inserted in the contract that but 60,000 square yards were to be flushed each night until such times as the engineer department could determine whether or not flushing damaged the pavement. Accordingly schedules for two routes for this limited area were prepared, and each route has been flushed on every alternate night since July 1 when the weather permitted.

There are two great difficulties that have to be contended with in street cleaning: (1) During dry weather fine dust accumulates on the pavement and is blown about by every breeze, much to the physical discomfort of pedestrians. It settles on the merchandise of the merchant and shopkeeper, damaging such delicate and perishable fabrics and articles as are exposed for sale, and rendering the stock generally less inviting to prospective purchasers. It finds its way into the home of the housekeeper who has been unwary enough to open the windows facing on the street, causing needless annoyance to the inmates, and making extra work where it would otherwise be unnecessary. It is a well established fact also that this fine dust is laden with disease germs, which are certainly not conducive to public health. (2) In damp and foggy weather a sticky substance oozes from and adheres to the asphalt, making the surface slippery and unsafe for horses, as owners of these animals know to their cost.

These conditions cannot be overcome by the use of machine sweepers or hand brooms, no matter how carefully or how often the surface is gone over. On the other hand flushing washes the pavement clean of all dust, the force of the water

cuts away the sticky substance, and both materials find their way into the sewers.

It is proposed to extend the flushing system to all the business streets and main thoroughfares in such a manner that each street will be flushed twice per week, and it is for this purpose that the $5,000 is included in the estimated increase.

STREETS AND LIGHTING

Good Roads—Track Elevation—Kansas City Pavements—Narrow Roadways—Cleveland Municipal Lighting.

The Good Roads Movement in the West.

The subject of good roads was considered for the first time by the Trans-Mississippi Commercial Congress at its fourteenth annual convention held at Seattle, Wash., Aug. 19, 20 and 21. The subject was thoroughly discussed by R. W. Richardson of Omaha, James W. Abbott of Denver, Martin Dodge, director of office of public road inquiries, Washington, D. C., and a number of other delegates from different states and territories, after which a resolution was unanimously adopted in the convention and by the committee on resolutions, as follows:

Recognizing that properly constructed highways are primarily essential to the highest development and commercial prosperity of the Trans-Mississippi country, and believing that it is neither equitable nor feasible to secure them wholly at the expense of the local districts, but that their cost should be pro rated among all interests benefited; therefore, be it

Resolved, by the Trans-Mississippi Commercial Congress, in convention assembled in the city of Seattle, that we urgently recommend to the several states that they adopt a system of highway improvement, under competent engineering supervision, embodying the general principles of the modern plan of state aid now successfully practiced in many of the older states; and that we favor the still further distribution of the burden by enlisting the aid of the national government, and request the active support of our representatives in congress for this policy.

Proposed Track Elevation in Evanston, Ill.

At an open meeting of the council at Evanston, Ill., Sept. 8, the railroad committee of the city council reported that during the summer the Chicago, Milwaukee & St. Paul road and the Chicago & Northwestern road had each submitted plans for track elevation to the committee; that the committee now has the plans submitted under advisement; that the plan submitted by the Milwaukee road was wholly for information—not official in any way—and the committee hoped to have the two roads formulate plans that would coincide. The committee also stated that the railroad companies had been asked to draw up an ordinance for submission to the committee which would be presented to the council.

Kansas City Pavements.

The annual report of Daniel P. Pike, city engineer at Kansas City, Mo., was filed Sept. 2. It states that the average yearly expenditure for paving for the four previous years was about $750,000, while for the last fiscal year it was $345,533.55, and practically all of that amount was for paving on old contracts. The reason that no paving contracts have been awarded during the last year probably lies in the contention between Mayor Reed and his council. Mayor Reed favors "open specifications," while the majority of the members of the council favor adherence to the old system of specifying exactly the kind of material used under the contract.

Wide Streets—Narrow Roadways.

The Improvement Bulletin thus puts the argument for narrowing street pavements:

The movement for narrow roadways in residence streets is gaining momentum and the idea is a good one, not only for large cities, but for small cities and country towns. It can easily be demonstrated that a twenty-four-foot roadway is ample for all practical purposes. The balance of the space usually left for the roadway and in many cases monopolized by weeds and rubbish, can be used to much better advantage. By widening the boulevard and tree space on each side

a pleasing effect is given that can be secured in no other way. The experience of all cities that have tried the plan—and there are many of them—is favorable. E. J. Phelps of Minneapolis, one of the early and earnest advocates of the system, thus summarizes its advantages:

First—Lessened original cost.

Second—Maintenance. A sprinkling cart can cover a twenty-four-foot pavement with one passage over it, whereas if the pavement is thirty feet or wider, it is necessary to go over the same block twice, thus doubling the cost of street sprinkling. If the street is kept clean by sweeping, twenty-four feet will present one-fifth less surface than a pavement of thirty feet, which heretofore has been considered by our people as the minimum width.

Third—Healthfulness. There can be no question that greensward without its accompaniment of dust is more healthful for a community than a pavement.

Fourth—the street with the narrower roadway can be lighted better, as the street lamps will be placed at the outer side of the boulevard, away from the trees.

Fifth—The wider boulevard affords more soil, more air, and more water to the roots of the trees in the boulevard, thus increasing their growth and beauty.

Sixth—The water mains, gas mains and wire conduits are in the boulevard rather than under the paving, consequently the paving once down, need never again be disturbed.

Seventh—The narrow paving presents less surface for the accumulation of dirt and dust which, blown about, injures furniture, clothing and carpets, to say nothing of the deleterious effect upon the exterior of residences.

Argument on Cleveland's Municipal Ownership Proposition.

The criticisms of the Citizens' Association relative to the proposed construction of an electric light and power plant at Cleveland, O., reports on which were submitted recently by E. W. Bemis, superintendent of water works, and C. E. Phelps brought out a statement by Superintendent Bemis, Aug. 31, which is as follows:

Much is made of the supposed failure of the municipal natural gas works of Toledo, but, first, many good judges hold that the plant was a good investment to the city because of the extent to which it forced down the price of natural gas. Second, the ending of the plant was due to the giving out of the source of supply in the natural gas fields many miles from Toledo. Such a situation could never confront an electric light plant whose raw material is coal. When coal gives out every industry will have to close its doors, but such a contingency need not worry us.

Xenia, O., with a population of less than 9,000 in 1900, is quoted as having lost money on its electric light plant which was finally sold, but even the purchasers were unable to make any money out of it and were obliged to let it go into the hands of a receiver. For every failure of a municipal plant several failures of private plants may be quoted and many successes of municipal plants.

Much is also made of the fact that the city of Columbus is spending from $300,000 to $400,000 for a municipal plant, but this is for the construction of a plant of 1,000 arc lights, while on the entire West Side of Cleveland there are today only 300 arc lights and the new city plant for $400,000 will certainly be able to take care of not only those but of 300 more arc lights and of a considerable amount of commercial service and public buildings. The Columbut plant, to be sure, was shut down for lack of an appropriation to run it from July 5, 1900, until Oct. 19, 1901, but it had only been run a year and had only cost for construction about $68,000. The then director of public improvements, who seemed anxious to turn the lighting of the city over to a private company, estimated that the entire cost per lamp was $90 per year, but he only reached this figure by an arbitrary assumption of 10 per cent. a year for depreciation or five times the average depreciation of all private owned electric light companies of Massachusetts during the last thirteen years.

During 1902 the operating expenses and full allowances for interest, depreciation, lost taxes, etc. bring the total cost per light under $63 per arc light, despite the fact that during 1902 the plant continued to be a very small one, with no receipts from commercial lighting. The Columbus plant, thus, is far from being a failure. The plant did not run last year as many hours as here in Cleveland where the city is paying $75 per light, but this was more than counteracted by the smallness of the plant last year and the other difficulties under which it was laboring from the efforts that had been made to wreck it.

The city of Hamilton, O., through its municipal plant, has largely reduced the price of electricity to the people and is selling electricity at much less than the ordinary consumer pays here. The Citizens' Association claims as against this that it costs the taxpayers of Hamilton more than $75 per lamp to operate the plant, or about $98, including interest. My own investigations on a recent trip to the city do not confirm these figures of excessive cost, although it is true that the city of Hamilton has allowed the spoils system to interfere with economical management.

The Citizens' Association also makes much of the assumed failure of a municipal gas plant in Bowling Green, a town of 5,000 population, in Wood county, but this also, like Toledo, was a case of a failure of natural gas and has no bearing

on the situation in Cleveland. The Chamber of Commerce and the Citizens' Association make a great deal of the supposed expense of the Chicago municipal plant and of a report made by some accountants three years ago in which they make an unduly large allowance every year for depreciation. The fairest treatment of the subject is as follows:

We must compare the cost of the Chicago municipal plant and the charges of the private plant in the same city. Thus we have the same conditions as regards cost of coal, amount of underground cable, etc. I have begun with the first year of the municipal plant in Chicago and have added together the entire amount spent by the city both for construction and operation, together with an allowance for water and lost taxes. From this I have subtracted what the city would have paid for the same number of lights from the private company at the price the city was then paying for the many lights it did so buy. The excess of the cost of the city plant for both construction and operation was the net expense of the plant. On that, 4 per cent. interest was reckoned and made part of the capital account for the next year. To this combined principal and interest was again added the excess for the next year of operating cost and new construction over and above what the city would have had to pay that year for the same number, and so on down to date. During the last few years the plant has been better managed than at first. It pays higher wages and requires less hours than the big private plant of the city, but nevertheless on the above basis of reckoning the plant will have entirely paid for itself in three years more; that is at the close of 1906.

In other words there has been during the last few years so great a difference between the charge for arc lights of the private companies and the operating expenses and interest on any net capital invested in the public plant, that the city has now been at a net expense of less than $650,000 for its 4,700 arc lights and is reducing this amount $200,000 a year. By this method of computation all questions of depreciation are set at rest, since the city has not only covered depreciation, but in three more years will have entirely paid for the largest street lighting plant in the world out of the difference between its operating cost and the charges of a private company.

If it be urged that the private plant would have charged less if there had been no municipal plant it can be urged with more plausibility that without competition of the municipal plant the company would probably have charged more than it did. Neither is it fair as urged above to compare the municipal plant in Chicago with the charges of the private plant in Cleveland, because the cost of coal is much less here and other conditions such as the intention to unite the proposed electric light plant here with the water works on a civil service basis and with an income from commercial lighting such as was denied to the Chicago municipal plant render the possibilities of low cost vastly greater here for the taxpayer than in Chicago.

Public School Instruction in Municipal Government.

A committee of the National Municipal league will investigate the subject of instruction in municipal government for pupils in elementary and high schools. William H. Maxwell, superintendent of public schools, New York city, is chairman of the committee. Information may also be obtained from Clinton Rogers Woodruff, secretary of the National Municipal league, Philadelphia.

WATER

Ohio Stream Pollution—Dayton's Water Supply—Meters for Pittsburg—Brooklyn Extensions—Breaks in Mains—Submarine Water Pipes.

The Pollution of Streams and Water Supplies in Ohio.

By C. O. Probst, Secretary State Board of Health, Columbus, O.

I am glad to note that "Uncle Sam" is beginning to take an interest in the quality of our waters, and in ways and means to preserve their purity. The Hydrographic Division of the U. S. Geological Survey, under the direction of Mr. Newell, has begun work in this line, and with public encouragement it should grow into something of some moment. Our water possessions are not less valuable than our land.

The Ohio State Board of Health began a study of streams and public water supplies in 1897. Every important stream, as well as Lake Erie, was examined. The territory of each water-shed was

carefully looked over by the Engineer. The character and amount of pollution going to each stream was noted as accurately as possible. Frequent chemical and bacteriological examinations were made of the streams above and below all towns of importance upon their banks. We have thus gained a general idea of the condition of our streams and public water supplies.

Let us consider first the Ohio River towns. We have in Ohio, East Liverpool, Wellsville, Toronto, Steubenville, Mingo Junction, Martin's Ferry and Bridgeport, Bellaire, Marietta, Pomeroy and Middleport, Ironton, Portsmouth and Cincinnati taking water directly from the Ohio River. In 1901, in an investigation of the Ohio River, we figured 1,961,922 inhabitants of villages and towns of 1,000 and over, upon the watershed above California. California is the site for the new Cincinnati water works. This represents 291 separate communities. Cincinnati and her suburbs are not counted, as no Ohio towns are affected by this pollution.

Note how the towns are grouped about the upper part of the river. All of them, from Bellaire up, are within 100 miles of Pittsburgh, with her enormous contribution of filth. Wellsville is but four miles from East Liverpool. Bellaire is within five miles of Wheeling, Bridgeport and Martin's Ferry, representing more than 50,000 people.

St. Louis is carrying on against Chicago the greatest suit ever started to prevent the pollution of water. Here the distance of flow and the amount of dilution for the sewage is vastly greater, yet St. Louis seems to be making out a very good case against Chicago.

Pomeroy and Mingo Junction are the only towns in this list that attempt to purify the water. The plant at Mingo Junction has not been very efficient. Cincinnati, as you know, is making radical changes in her water supply and will eventually have, no doubt, an excellent filtered water.

Marietta and Pomeroy probably receive water the least subject to pollution, but it may be doubted whether the Ohio River anywhere affords a safe water supply for Ohio towns.

One peculiarity of the Ohio River water should be noted in connection with filtration. At times the river water from Portsmouth and above does not carry sufficient carbonates to take out all the alum needed to clarify the water by mechanical filtration. On several occasions we found alum in the filtered water at Pomeroy. When the water is in this condition lime should be added to the unfiltered water.

Lake Erie has been looked upon as an ideal source for pure water. Many Columbus people say, "Why don't you go to Lake Erie for a water supply?" Lake Erie is a very shallow body of water. During storms the wave action stirs up deposited mud for eight to ten miles or more from shore. The lake water will, therefore, frequently be muddy, for the intake can scarcely be carried this distance.

The lake has a very slow current, normally to the east, but quickly changed by winds to the west. At Toledo, during a period of five years, the wind was to the west for a total of 16 months of that time. At Cleveland, during five years, the wind blew almost as many hours from the east as from the west. Surface currents, carrying sewage, will often be westward. An intake a short distance west from a sewer outlet, gives but slight protection against polluted water.

No city can expect to run its sewage into this lake and take a pure supply of water out of it. The result of the Cleveland experiment may require this statement to be modified. They propose to carry all their sewage 10 miles to the east of their lake intake, which is also to be extended. This will, no doubt, greatly improve their supply. Muddy water they will certainly have at times. A satisfactory public water supply must be clear, and it is extremely probable that Cleveland will yet be compelled to resort to filtration.

Lorain and Conneaut have filtered lake supplies. Lorain put in filters in 1896. They have been highly satisfactory as regards reducing the deaths from typhoid fever. An attempt to cheapen the process by substituting iron for alum was a failure. The filters did poor work, and were much damaged by the experiment. Last July it was necessary to shut down the filters to repair them.

The typhoid history of Lorain is worthy of a paragraph. Using a polluted lake water, they had 43 deaths from typhoid in the five years prior to putting in the filters or 8 3-5 per annum. Until August this year there had been no deaths from typhoid. The filters were shut down in July, as stated, and within six weeks thereafter they had three deaths from this disease.

Conneaut has had an interesting experience. In 1899 her Cooke wells failed to supply enough water, and the lake intake was opened. A serious outbreak of

typhoid followed, which seemed clearly traceable to the lake water. Filters were introduced in 1899 and there was no more typhoid for some time. But another outbreak occurred in 1901. It was shown that just preceding this little or no alum was used. Filters should be operated on the scale of efficiency and not of cost, and water works officials should be held strictly accountable for cheating of this kind.

The water supplies of a few cities, derived from interior streams, may be referred to. Columbus is the most important of these. It has gained a most unenviable notoriety in regard to its water supply during the last few weeks. Supplied by ground water, reasonably pure, during the wet months, it must resort to the Scioto River and next to Alum Creek in times of drought. Both streams are impure and unfit to drink in a raw state. Excellent plans for a pure supply have long ago been adopted. We know what to do. The trouble is to get it done. Politics and injunctions have seemed to control the situation.

Youngstown is in the thick of a water fight. They are also in the midst of a bad typhoid fever epidemic, with about 70 deaths so far this year. Their supply is from the Mahoning River, which was condemned by the State Board of Health several years ago as an unsafe supply. Here, as at Columbus, pressingly needed improvements may be delayed by interests which should have no consideration in a question of this kind.

Warren, a short distance above Youngstown, is filtering the Mahoning River water. They have practically no typhoid, and their supply is quite satisfactory.

Toledo draws her supply from the Maumee. The supply is not seriously polluted, but is becoming more so. It is extremely muddy at times, and is unsatisfactory in this respect. A Commission of Sanitary Engineers has recommended the Maumee, higher up, with filters. Lake Erie was considered as a source of supply. It was much more expensive, and all agreed that it would have to be filtered.

Zanesville, Akron, Lima, Springfield are other interior towns where the water supply is more or less unsatisfactory and where improvements have been advocated. This list could be considerably extended.

Dayton is a most fortunate exception to the large interior cities of Ohio as regards water supply. Nature has provided her with an immense deposit of water-bearing drift from which she obtains an abundant and excellent supply. There is no excuse for intemperance in Dayton. The water is everywhere pure and good.

It may be said, I think, that with few exceptions none of the streams of Ohio affords water of sufficient purity for a safe domestic supply. The head waters of a few streams, by impounding and sedimentation, may still furnish a fairly safe and satisfactory supply for smaller towns that are accessible to them. Such towns will be better off with a ground water supply where it is obtainable.

With some of the streams their pollution in certain places during the dry seasons has already reached unbearable proportions. Their waters have become wholly corrupt, unable to support animal life, and are the source of intolerable nuisances. A few examples may be cited.

Mill Creek, from the sewage of Cincinnati and suburbs, has become a common sewer. It is the source of annoyance to thousands of families, and has been a cause for complaint for many years. An investigation of this stream was recently made by the State Board of Health. It was computed that fully 125,298 people contributed to the sewage pollution of Mill Creek. An enormous quantity of trade wastes also enter it. A Mill Creek Valley Improvement Association has grown out of this investigation, and an intercepting sewer to carry all sewage now entering Mill Creek to the Ohio River is being agitated.

The Cuyahoga River at Cleveland is another example of bad stream pollution. The work going on at Cleveland plans to finally relieve this stream of all sewage.

The Capital City is sinning most grievously in this direction. The Scioto River below Columbus, but within range of the noses of thousands of her citizens, is often an exceedingly foul stream. Alum Creek, which receives much sewage, is considerably worse. I recently examined it, and the conditions found should disgrace any city. Plans have been made which would remove these conditions, but the everlasting question of money and politics prevents anything being done.

At Findlay, at Tiffin, at Galion, at Lima and at many other places that might be named there is more or less trouble from nuisances due to stream pollution.

What is the remedy? Our laws prohibit the pollution of streams, but there seems great difficulty in having them enforced. A number of suits have been brought against Columbus within the last ten years, but the nuisance continues and is growing worse. The State Board of Health is doing what it can to protect the streams. An Act of 1893 provides that

no person or corporation shall introduce a sewer system, or change or extend any sewer outlet already in use, without the approval of that Board. Under this Act public water supplies have been protected, and stream pollution stopped as much as possible. The Ohio River affords an interstate problem. It would be of little avail to require Ohio towns to purify sewage going to this stream so long as cities on its other bank send raw sewage to it.

We should legislate wisely for the future. Conditions are growing worse. Minimum stream flows are becoming smaller and the various sources of their pollution are steadily increasing. England has created river conservancy boards with power to prevent the further pollution of her streams, and to gradually bring them back to something near original purity. We should do well to follow some such line in Ohio. We should now enact and enforce laws for the prevention of what must otherwise be intolerable conditions twenty or thirty years hence.

In conclusion I would say that we can never hope to keep our streams fit for domestic water supplies, police them as we may. Our large cities must look to purification as their only remedy; but no matter what form of purification is provided, it is better that the raw water should be as pure as possible.

The Water Supply of Dayton.

Mr. Harry J. McDargh, consulting, civil and hydraulic engineer, read the following paper before the Central States Water Works Association.

The water supply of Dayton is taken by means of eight-inch tubular wells, from a bed of glacial drift, composed of sand, gravel, boulders and some unstratified clay. This particular drift which is used for our source of supply is the Mad River Valley, and is a natural reservoir of some thirty miles in length above our well system, and several miles in width. The bottom of this glacial drift has been tested for at only one place, and at that point it reached a depth of over five hundred feet.

The purity of this supply has been proven by frequent bacteriological and chemical tests, as well as by the very healthful condition of the city. Also its potability is due to there being no danger of pollution near or above the supply, its own natural filtration, and that the temperature of the water is so low and its activity too great for bacterial propagation.

There are ninety-four wells in this system, and they cover a territory three thousand feet long by three hundred feet wide. The wells are eight-inch, galvanized iron pipe being used, and are of various depths, ranging from twenty-five to eighty-nine feet. The various depths are the result of "staggering" the wells so that bunches of adjacent wells draw water from different levels. Each well is fitted with a Cook brass strainer from eight to ten feet long. In driving the wells it was found that the first fifteen feet was usually a mixture of loam, clay and gravel. After leaving this depth a water-bearing stratum of loose, clean, coarse gravel was encountered, which continued to any depth which we might go. Personal supervision was given to the driving of each well, and from external conditions judgment could be passed as to when a proper stratum had been reached. After a thorough cleaning, the brass screen was set and the well tested by connecting direct to a centrifugal pump and the discharge measured by a weir.

The principal suction main is a sixty-inch hub and spigot pipe, laid to a true grade of one inch per hundred feet, descending from the pump house. Each well was connected either singly, in pairs or in groups of three or four to this main suction pipe by lateral mains of proper size, laid to a grade of six inches per one hundred feet, ascending from the well to the suction main. The method pursued in laying suction pipes enables any and all air that arises in the wells to be carried to the pump house, where an air chamber set over the suction main collects it. The main suction pipe has valves set at various points in its length, and the wells, too, are each fitted with a valve so as to enable the closing off of either a single well or any combination which may be desired.

The capacity of these wells from actual test after the completion of the system was about thirty-six million gallons in twenty-four hours.

Some interesting data of the wells are: Greatest depth, eighty-nine feet; least depth, twenty-five feet; greatest amount of water by an individual pumping, five hundred and sixty-two and one-half gallons per minute; least amount, one hundred and eighty-one gallons; lowest temperature, forty-one degrees F.; highest temperature, fifty-five degrees F.

The cost of this work, based on the following principal units, i. e.: Cast iron pipe, $29 per ton; excavation, 75c per cubic yard; sheeting, $19 per thousand;

well driving, $1 per foot; pumping, etc., at actual cost, was:

60, 30, 12 and 8 in. pipe, reducers, bends, etc.	$ 28,101 34
Saddles and specials for well connections	832 50
60, 30, 12 and 8 in. valves	3,293 90
Driving new wells and material	11,909 26
Excavating, sheeting, pumping, back filling	58,977 04
Advertising	219 87
Miscellaneous	390 35
Engineering, superintending, inspections, etc.	6,630 52
Total	$110,354 78

The Meter Question in Pittsburg.

The introduction of water meters in Pittsburg is opposed by Mayor William B. Hays, who declares that water meters will prevent cleanliness. He takes the view that the consumers, if paying for water by meter will economize beyond the point of necessity, thus detracting from cleanliness of premises if not of persons. If the mayor could be put into position to have the actual experience he would find that a liberal allowance of water under a minimum rate would bury deep his objection. A well chosen limit, below which the charge is the same no matter how much is used, does not restrict legitimate use of water. It catches the waste, which the careless consumer should pay for, not the careful one, as at present.

Extensions of Brooklyn's Wate Supply.

The borough of Brooklyn has outgrown the present water main service, according to the annual report of 1902 of Robert Grier Monroe, commissioner of water supply, gas and electricity. A table showing the average daily supply and consumption of water from the Brooklyn system for 1901 and 1902 is as follows.

	—Gallons.— 1901.	1902.	Gallons.
Ridgewood system	$8,020,881	92,255,026	Inc. 4,234,145
Gravesend, New Utrecht	8,699,722	8,050,459	Dec. 649,263
Totals	96,720,603	100,305,485	*3,584,882

*Net increase.

He says "the increase of supply over 1901, 3.6 per cent., was about proportionate to the estimated annual increase in population. It was made possible by favorable conditions of rainfall and the introduction of water through the new pipe conduit since last September. Preparations for increasing the water supply of Brooklyn have been directed toward the further development of the Long Island water shed in the way of underground water, and also toward making safe and available certain surface waters by the installation of filter beds or plants. After investigation it was decided that the greatest quantity of underground water could be secured by the establishment of infiltration galleries throughout both the new and old water sheds. The infiltration gallery consists of a system of pipes laid with open joints beneath the water bearing stratum and draining into a receiving well from which the water is forced or pumped into the conduit. By this method a large proportion of the underground water which would otherwise reach the sea is intercepted. Surveys have been made preparatory to securing the land necessary for two of these galleries, and a third gallery with the necessary pumping station is in contemplation."

Some Breaks in Water Mains.

J. R. Maxwell, in a paper on pipe and conduit systems, reported the following observations made by him of causes for breaks in water mains to the Central States Water Works Association.

Force mains and conduits frequently give way in places where there seems to be ample strength, so far as can be determined by calculations based upon the rules in common use by hydraulic engineers. I will refer to a few cases that have come under my notice.

The first case was that of Newport, Ky., in the year 1872. The conditions were about as follows: The pumps were double-acting outside packed vertical machines, and in times of low water raised water some distance by suction, and no doubt took in some air around the plungers unless they were very carefully packed. The rising main was laid up a very steep hill in a sort of zig-zag line. The hill being very slippery, the pipes settled so that pockets were formed in which air could accumulate, making the outflow at the top of the pipe spasmodic and irregular, so much so that when the pumps were stopped the fluctuations in the pipe would cause the gauge to rise and fall violently for several minutes before coming to rest. This condition continued with an occasional burst in the main until the pipe was relaid in the proper manner. The rising main was open at the summit, and the water flowed freely from it into the pipe leading to the reservoir. It would seem that not much air would follow the water into this pipe,

but it was found that, as the pipe followed the undulations of the territory over which it passed, air collected in the higher points, and in some way started violent waves, which burst the pipes. This condition continued troublesome for several years, until George Hornung, while in charge of the water works, studied the situation and applied the proper remedy, air vents at the high points.

Another case was at Springfield, Ohio, in 1881. The force main leading from the pumps to the tank followed the Lagonda pike, rising and falling to suit the road, and the pipe was ruptured several times while the standpipe was being built. During the time there were no water takers along the force main and but few had tapped the pipes in the city. The pumps were used during the daytime to pump up the platform used in building the standpipe, which is thirty feet in diameter and one hundred feet high, situated on a hill. The pumps stood still through the night, and in starting in the morning some air was forced into the main, and it would accumulate in the high points in the main and in stopping and starting the pumps violent waves were started, having sufficient force to burst the strongest pipes.

After the main was tapped in several places to draw the air out, and the pumps were put in constant use, the trouble was remedied, although the regular pressure had increased by about 100 feet head when the standpipe was finished.

There are now patent air vents that will remedy such trouble if kept in order.

Submarine Water Pipes.

T. R. Cook, superintendent of the water works at Toledo, spoke as follows on "Repairs to Submarine Water Pipes," at the recent convention of the Central States Water Works Association:

I will only speak of these breaks or leaks where coffer damming is out of the question, on account of the expense as compared with either methods of procedure. My experience in this work while not extensive, has been quite varied. I have observed that the contemplation of a perplexing or apparently difficult job is more harrowing to one's nerves than the actual doing of the work.

We have in our city two thirty and two sixteen-inch force mains under water, the two former but a short distance, one of the latter for about 1,600 feet, all from eighteen to thirty feet below average stage of water.

In navigable water the pipe should be laid in a trench prepared for it, to a depth below the bottom of water of not less than five feet, and then covered even with the original bottom. This to insure—in case that an anchor from some vessel was dropped—it would not catch on the pipe, or a dredge spud or anchor would not hit it.

A leak in a pipe covered with twenty-five or thirty feet of earth and water is not generally discovered until the leak is quite a serious one, especially if the leak is on the bottom or side of the pipe, where the escaping water does not have a chance to make a ripple or some commotion on the top by which they are usually located, unless, of course, there is a break or rupture so serious that it can be noticed at the pumping station by the pumpage running up to an undue amount.

A very small leak in a joint, especially where submerged pipe is laid on a sandy bottom or covered with sand when laid, is sure to become a serious matter in time, as the water escaping from the joint even in a small jet, makes a commotion in the sand which constantly whirls and eddies against the side of the pipe, acting in the nature of a sand blast and with the same result, and you will eventually find that about four or five inches from the joint the sand will cut the pipe away until a hole is cut clear through it, too close to the hub end of your pipe to permit of your putting an ordinary half sleeve on, with any chance to make a perfect and permanent job.

In troubles of this kind there is always that element of uncertainty as to just what the character of the trouble is, and, of course, you cannot tell until an examination at close range has been made, and right there you have to depend upon some one else. The submarine diver—a very necessary and expensive evil, that you must have and you are in great luck if you can get him promptly. A man to do this work should not only be a good diver, but he should be a mechanic and ingenious. When it is remembered that generally in our water, where not a ray of light can reach him and all his work is done in pitch darkness, it is surprising what work he accomplishes and it is no wonder that sometimes, though not often, he fails in making a perfect job.

When you have but one force main supplying any considerable portion of your city, it is imperative, of course, that you have it shut off for as short a time as

possible that you can make temporary repairs until such time as you can get your patterns and castings out to make a permanent job. The first difficulty of any moment you will encounter is removing the earth from on top and around your pipe so that you can get at it, and it generally saves time in the end to do this job thoroughly and well, so that you will have plenty of room. I find the best method for doing this work is to employ a so-called "sand-sucker," if one can be procured, which in our locality we have no difficulty in doing, which with their ten-inch suction pipe and large centrifugal pumps they can do very quickly.

Small leaks in joints can often be stopped by driving in copper wedges, also tea lead that can be calked cold. Where the pipe is worn through by sand a half sleeve can be applied.

The diver should use great care in calipering the pipe at both ends of where sleeve will be placed and he should note if the pipe is even or if there are lumps or rough spots on it; if there are such they should be chipped off with a cold chisel. The flanged half sleeves, after being put on the planer, flanges smoothed and drilled for bolts to clamp together, should have holes drilled about three-quarters of an inch deep and three and one-half inches from end of sleeve, to hold the lead in when the sleeve is poured. When the sleeve is on the planer a groove should be cut in the lower flange—say three-quarters of an inch wide at the top and tapered to one-fourth of an inch at the bottom of groove. The top flange should be fitted with corresponding boss so that it will fit into groove. This should be between bolt holes and inside of flange. This not only secures a better joint, but it enables the diver to place the castings in their proper positions more readily.

When the sleeve is prepared select a piece of pipe that is just the diameter of your submerged pipe, clamp sleeve on and pour joints, being careful to put shims between castings to keep them apart the thickness of the lead gaskets (what is known as 6 or 8-pound lead. Then take a key-hole saw and saw your lead apart between the flanges, the shims that you have previously put in giving you plenty of room for this purpose, then take your casting off and you have it all ready for the diver to put on your submerged pipe. In large-sized pipe an eye-bolt should be tapped in at both ends of the top casting, to make fast to when casting is lowered into position. After bottom casting is lowered and placed under pipe, it should be blocked up to pipe firmly, then top casting lowered, bolts put in and screwed up firmly and then all that remains to be done is to calk the lead in ends of sleeve.

I recently applied a sleeve on to a 16-inch pipe that covered a ball joint in the pipe. The sleeve was 42 inches long and weighed something over a ton.

In removing a whole pipe or a piece of pipe, the joints can be made very successfully in the same manner.

MUNICIPAL AND TECHNICAL LITERATURE

New Publications—Municipal and State Reports.

New Publications.

Heating and Ventilating Buildings. A Manual for Heating Engineers and Architects. By Rolla C. Carpenter, M. S., C. E., M. M. E. Fourth edition, revised and enlarged. 577 pp. 477 figures. Cloth, $4. John Wiley & Sons, New York.

The new chapters in this edition are those on the fan or blower, on mechanical systems of heating and ventilating, and on school house heating and ventilation. Considerable new matter has been added in other chapters, bringing in the advances in the art of heating and ventilating during the seven years since the first edition was published and increasing the size of the book by one-third. It is now a compendium of information upon its subject and gives the best combination of theoretical discussion with the results of practical use and experiment which is obtainable.

Eleven chapters are devoted to steam and hot water heating and the development of rules for designing systems is thoroughly worked out, the final statement of the rules being in excellent form for easy and quick reference. The introductory chapters consider the nature and propeties of heat and the different methods of transmitting it, the amount of heat required and the principles of ventilation. The details of radiation surfaces, pipe and fittings, the design, settings, appliances and operation of boilers and hot water heaters are quite fully considered. The methods of using exhaust steam are also briefly described. One chapter is devoted to methods of heating with hot air, one to electricity, one to temperature regulators and one to specifications, proposals and contracts, in addition to the new chapters above mentioned. The text and the appendix contain many tables of great value to the engineer designing heating systems.

Mr. Carpenter has had much experience in the line of this work and is well qualified to write the book. To his own authoritive work he has added that of other experts, so that the book contains the best upon its subjects. He is to be commended for putting it in such convenient shape for use.

Irrigation Institutions. A discussion of the economic and legal questions created by the growth of irrigated agricultulre in the West. By Elwood Mead, C. E., Chief of Irrigation Investigations, U. S. Department of Agriculture, etc. 392 pp. half leather, $1.25, net. The Macmillan Company, New York.

A very valuable history of the development of irrigation in this country and of the methods of regulating the ownership and use of the water supplies of the arid and semi-arid regions for its best use is given in this book, which is one of the Citizens' Library of Economics, Politics and Sociology.

The vast differences in climate, temperature, rate and time of rainfall, soil, customs and laws in the half billion acres of land requiring irrigation make any fixed method of regulation impossible. Mr. Mead shows clearly the failure, on account of lack of knowledge of the conditions, of the application of homestead, pre-emption, timber culture and desert laws regulating the granting of titles to lands requiring irrigation. He describes the beginnings of irrigation in this country and the development of the doctrine of appropriation of water as a property right either belonging to or separate from the title to the land to be irrigated. Contract water rights, the measurement and the duty of water are subjects of chapters.

The laws governing irrigation and the general practice in Colorado, California, Utah and Wyoming are given in some detail as typical methods, the other states being described much more briefly. The contrast between the conditions in the first three states and the last is very marked and is intentionally emphasized by the author as he rightly considers that the general principle upon which Wyoming operates is vastly superior to those in use in the other states. In a few general terms it may be said that most of the states proceed upon the doctrine of appropriation, described in one of the book's chapters, with many variations in detail, while Wyoming regulates the distribution of water through state control. The first method gives rise to endless litigation among conflicting interests, one decision being overthrown by claims filed later, with new evidence requiring a new adjustment. The Wyoming method limits the maximum claim to a fixed amount, determined as the average of experience in that state, and regulates the distribution of the available water according to the needs of each irrigation district. The superiority of this plan is shown by the infinitesimal amount of litigation in that state as compared with the flood of suits in the others. The necessity of radical changes in methods of control of water supply in many states is clearly shown and some approach to the Wyoming plan is evidently favored by the author. He shows that one of the greatest improvements in future must be in the provision of storage capacity so that the supply of water during the irrigating season may be ample. The great variations in the storage problem are briefly indicated. The book is another valuable addition to the literature on this subject and should have much influence in improving the methods of developing what must one day be one of the most important sources of food supply for the world.

Calculations in Hydraulic Engineering—A practical text-book for the use of students, draughtsmen and engineers. Part II, calculations in hydro-kinetics, with numerous illustrations and examples. By T. Claxxton Fidler, M. Inst. C. E. 202 pp., cloth, $3. Longmans, Green & Co., New York.

The main object of this book seems to be the development of a formula for computing the uniform flow of water in logarithmic form. At the same time it goes

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into detail of methods of computing hydraulic problems more closely than many other books and should serve as an excellent guide to computers in this branch of engineering.

The first chapter discusses the phenomena of the flow of water in channels and pipes and the resistances met with. The second describes many of the experiments which have been made on pipes and the third on channels. In the fourth chapter he starts with the formula for the slope in the general form of the ratio between velocity and hydraulic radius, each with an exponent, the ratio being further modified by a constant multiplier. This formula is evidently handled readily by means of logarithms. From the results of the experiments described in the preceding chapters he derives values of the constants in the formula for each class of experiments. In the fifth chapter he shows how to make calculations of velocity, gradient, diameter, discharge, etc., and in the sixth the allowances for inlets, outlets, constrictions, such as the venturi meter, etc., are discussed. The seventh chapter shows piezometer diagrams for various conditions of flow in pipes, methods of breaking pressure in long lines of pipe under heavy pressure, as in the case discussed on page 18 of the July number of Municipal Engineering, surface conditions, bends, filling of lock chambers, etc. The eighth chapter considers natural water courses. Most of the usual formulas for hydraulic computations are referred to and given but the author's form of logarithmic formula is most in evidence. In the last chapter this formula is put in shape for easy computation for circular pipes and channels of curved section

$$\text{Log. s} = -6 + x\,(1.06 + \log. \text{V} - \tfrac{2}{3} \log. \text{R.})$$

and for channels of rectangular section, the same except that 1.10 is substituted for 1.06. A table of values of x for the various experiments is given, ranging from 1.7355 for channels lined with neat cement to 2.173 for dry rubble masonry.

The Coffer-Dam Process for Piers. Practical examples from actual work. By Charles Evan Fowler, M. Am. Soc. C. E. 8vo. Cloth, 173 pp: $2.50. New York: John Wiley & Sons

Mr. Fowler has supplied some descriptions, fully illustrated, of the various methods of constructing coffer dams for piers, which were greatly needed. The first article gives a historical review of the subject, and the remainder of the book illustrates and describes the modern methods of solving the problems which arise in the process of keeping water out of the site for a foundation.

Crib coffer-dams, pile driving, sheet piling and construction therewith, metal piers, pumps and dredges, foundation bottoms and methods of treating them, concrete and methods of handling it and other materials, the location and design of piers all have very satisfactory treatment and the book should find many interested readers.

Experiments on the Flexure of Beams, resulting in the discovery of new laws of failure by buckling. By Albert E. Guy. 122 pp. cloth. $1.25 net. D. Van Nostrand Company, New York City.

The chapters in this book were first published in the American Machinist. They first state the limitations of the ordinary theory of the action of beams, so far at least as the determination of the breadth of cross section is concerned, and then give the results of a number of experiments upon small wooden beams, one to two inches in length, one-eighth to one-fourth inch in breadth and one to two inches in depth. The laws developed from the results of these experiments are stated as follows:

First Law—The load causing the buckling of a beam through flexure is inversely proportioned to the square of the length upon which it acts directly.

Second Law—The load is directly proportional to the cube of the thickness and to the depth of the solid or, generally, directly proportional to the moment of inertia of the section of the beam considered, taken in reference to an axis passing through the center of gravity of the section, parallel to the direction of the load.

Third Law—The total effect of one or several forces or of their components is equal to the algebraic sum of their individual efforts.

It is shown that Euler's formula for posts applies equally well to long beams, whether horizontal or inclined.

Several examples showing methods of determining sections of beams under various conditions are worked out as samples of the methods of applying the laws in practice.

The author states that his experiments were conducted to add to the existing knowledge of the resistance of materials and they were restricted to the question of the failure of beams by buckling, which begins in the compression flange. While, as he states, the experiments on small beams are not entirely conclusive, since the action of beams on a large scale may not be accurately indicated by them.

MARION COUNTY COURT HOUSE, INDIANAPOLIS.

the results are sufficiently definite to warrant the conclusions drawn and to show the great desirability of full series of similar experiments on large beams such as might be put into actual use.

While some similar experiments have been made by at least one other, Mr. Guy seems to be the first to formulate the facts established and reduce them to law. The preliminary work of this sort is perhaps easiest done on a small scale, but the laws thus developed must be tested upon the scale of actual construction before they can be safely assumed as the basis for structural design.

Mr. Guy promises a more voluminous work going more into detail and discussing other applications. It is much to be desired that he, or some one with time, money and the necessary enthusiasm and training, will be able to make the experiments on a larger scale which are needed to put the work already done upon a solid foundation.

Municipal Public Works, their Inception, Construction and Management. By S. Whinery, C. E. 241 pp. $1.50 net, postage 15 cents. The Macmillan Company, New York.

Mr. Whinery's book is of great value not only for the inexperienced city official and the urban citizen, but for those of the longest experience and with the most expert knowledge. The author has had long experience with municipal affairs, largely from the side of the contractor for municipal improvements, and he gives a full, free and honest discussion of the difficulties in the way of efficient management of public works by city officials.

The titles of the chapters will show the scope of the discussion and its general trend. They are as follows: "Importance of Municipal Public Work," "Municipal Organization," "Preparations for Municipal Work," "Direct Work vs. Contract Work," "Advertising, Opening Bids and Awarding Contracts," "The Contract," "The Contractor," "The Supervision of Public Work," "Maintenance and Repair of Public Work," "Economy, Real and False," "Guaranteeing Public Work," "Special Assessments," "Municipal Accounts and Uniform Accounting," "Municipal Ownership," "Quasi-Public Corporations and Their Control."

Readers of the editorial department in this magazine will find in this book in logical order and in clear and condensed form conclusions very similar to those expressed from time to time in discussions of current events in this field. Mr. Whinery is specially competent by training and experience as well as natural turn of mind to present the general view contained in this book and he has prepared a volume which should be read by every citizen as well as by every official, expert or ignorant. A thorough understanding of its principles is bound to bring about great improvements in municipal administration.

Modern Civic Art, or the city made beautiful. By Charles Mulford Robinson. 375 pp. Cloth. $2.50 net. G. P. Putnam's Sons, New York.

Mr. Robinson's book is as complete on the aesthetic and artistic side of municipal improvement as Mr. Whinery's, elsewhere reviewed, is upon the physical or material side.

He considers the definition of civic art and the various governing points and lines of municipal design from the standpoint of beauty, with full attention to the demands of utility. The city's focal points are assumed to be the water and land approaches, the latter now most commonly the railroad station, and the administrative center. In the business district the street plan, architecture street furnishings and adornments are the salient points for consideration. In the residential sections they are the street plat, the treatment of the great avenues, the minor residential streets and the tenements. For the city at large the discussion includes the comprehensive plan, whether of the rare new city or for the modification of the existing city, the treatment of open spaces of various kinds, of parkways and parks. A very interesting chapter is that on the principles of occasional and temporary decorations for various celebrations and festivals.

Mr. Robinson says with reference to his complete plan for restricting street advertising and improving the street furnishings: "There is not a particle of it that has not now been somewhere framed in city ordinance, revealing a public approval of each individual item in the count, and an imagination that popularly has tried its wings and needs only daring to fly far." The same may be said of the entire scheme so beautifully presented in the book. It is occasionally called a dream, but it is only so in its entirety.

All of the results so alluringly set forth have been obtained somewhere, but no city has them all. The dream of the whole sets the goal in each of the many lines of effort and each community can find the ideal of its particular desire somewhere in the comprehensive plan. Each can obtain far more than it now deems possible if its citizens can draw

INDIANA SOLDIERS' AND SAILORS' MONUMENT, INDIANAPOLIS.
Hotel English on the Left. Columbia Club in Background.

inspiration from the picture of the beauty of the whole. In this sense the book is eminently practical, though at first view and as a whole it seems so visionary. Criticism on the latter account is neatly disarmed at the start until the reader has had time to recognize the true nature of the book.

Municipal and State Reports.

Municipal Manual for the City of Altoona, Pa., for the fiscal year 1903-4. W. J. Hamor, City Clerk; Harvey Linton, City Engineer; S. M. Hover, Mayor.

In vest-pocket book form this volume presents the city roster, regulations, appropriations, financial statements, water department statistics, rates and rules, municipal statistics and comparisons with other cities, etc. It is a marvel of condensation and at the same time of comprehensive treatment of the municipal departments.

Annual Report of the President of the Borough of Brooklyn for the Year 1902. J. Edward Swanstrom, Borough President.

This volume is presented with the outside cover title "One Year of Non-Partisan Municipal Administration." Four years under the Greater New York charter were not satisfactory in the amount and character of public improvements but the amendments which gave the borough president more power and made it possible to reduce the amount of politics in the administration are shown in this report to have had good effect. Some of this was shown in this magazine in a review of this report which appeared in the July number, the report having first appeared in the City Record. The present volume is fully illustrated with photographs and is accompanied by a number of maps which add much to its value and convenience.

Report of the Committee on Charles River Dam. 1903. Henry S. Pritchett, Samuel M. Mansfield and Richard H. Dana, Committee. John R. Freeman, Chief Engineer.

This committee was appointed in 1901 by the state of Massachusetts to consider the advisability and feasibility of building a dam across the Charles river at or near Craigie bridge. The present volume of 572 pages with many maps, drawings and photographs, is the result of its labors. The object of the dam, which has been discussed since 1859, is to improve the sanitary condition of the Charles river above the point of its location. The dam is reported to be entirely feasible at a reasonable cost. It is shown to be desirable as a measure of sanitary betterment; as an additional open area which may be considered to be added to the park area of the city; as a waterway which will then be convenient and sufficient for a large passenger and freight traffic between the parts of the city and its near suburbs bordering on it.

The present sanitary condition of the stream and the probable conditions with the dam have been studied at length and are fully reported upon. Some changes in sewers and drains are recommended, and some dredging of sludge.

The portion of the cost chargeable to the account of the improvement of the basin by a dam is $1,236,000, of which seven-twelfths should be assessed to Boston, three to Cambridge and one each to Newton and Watertown. The dam itself, which will also form a bridge, will cost $1,425,000, no more than the required new bridge at the location, and should be assessed to Boston and Cambridge. At least two-thirds of the first figure named would be required in improvements if the dam were not built, so that the improvement really costs less than $500,000 more than far less satisfactory absolutely necessary construction.

Besides the committee's report the volume contains the reports of John R. Freeman, chief engineer; Dr. Theobald Smith of the Harvard Medical School, who investigated the probable effect of the proposed fresh-water basin upon the occurrence of malaria; Harry W. Clark, who made chemical and bacteriological investigations of the present pollution; X. H. Goodnough, who has made a study of the possible amount of pollution in ponds or streams without producing nuisance; Geo. W. Field, biologist; W. O. Crosby, geologist, and a number of studies of harbor conditions, details of subsidiary improvements and estimates of cost. It also contains Mr. Freeman's paper on the subsidence of the city of Boston.

Some more detailed references to particular reports will be made later as occasion offers.

The committee deserves the highest praise for the thorough manner in which it has attacked the subject and the complete and concise answers which it gives to the questions submitted to it.

New York State Museum. Bulletin 61. Quarries of Bluestone and Other Sandstones in the Upper Dominion of New York State. By Harold T. Dickinson. 112 pp. paper 35 cents. University of the State of New York, Albany, N. Y.

As its title indicates, this pamphlet con-

COMMERCIAL CLUB, SOUTH MERIDIAN STREET, INDIANAPOLIS.
Place of Meeting.

siders the characteristics and mode of occurrence of certain New York sandstones and describes and illustrates the quarries of the state. It should be a valuable publication in this line.

Supplement to the Annual Report of the State Engineer and Surveyor of New York. E. A. Bond, State Engineer. W. P. Judson, Deputy.

This volume contains the report for 1902 of the gaugings of the volume of discharge of streams by Robert E. Horton, with an appendix on the measurement of stream velocities in vertical planes. The effect of ice in changing the line of maximum velocity to mid-depth is clearly shown in one set. The observations were taken under the joint management of the State Engineer and the United States Geological Survey, and the volume closes with a short report of the progress in other branches of the survey work during the year. The annual collection of these data with the full data regarding rainfall which are being collected in New York will give a basis for more satisfactory estimates of the relations of stream flow and rainfall than have heretofore been possible.

Annual Report of the Street Commissioner of Somerville, Mass., 1902. John P. Prichard, street commissioner.

The streets of this city seem to be of macadam and the city is fairly well equipped to take care of them with a stone quarry, a crusher which broke 16,000 tons during the year, two steam road rollers and one asphalt roller, and twenty-eight sprinkling carts, each serving its own fixed district at a uniform price of $80 a month. The report is illustrated with views of the work done during the year, which amounted to about $21,500 for new work. The city has ninety-two miles of streets, of which sixty-five miles are public, but the total extent of improvements is not stated in the report. An important event of the winter was the fight against the brown-tail moths on the street trees, which cost $6,000 and is not yet over. The street commissioner has charge of the street trees, maintaining, removing and planting them.

Water Works at Emmettsburg, Ia.

The report of Superintendent Henry Kneer of the Emmetsburg, Iowa, waterworks shows 37,740 feet of pipe, 10 per cent. of which was laid last year. Over half the pipe is four-inch, nearly one-fourth of it is six-inch and nearly one-fifth from one to two-inch. The largest size is eight-inch. The total cost of the mains, pumping station, thirty-five hydrants and other fixtures was $34,703.58. There are 114 meters in use. The pump-house, including superintendent's salary, cost $986 for the year, and new mains and new services cost $4,658. Coal cost $312.75 and repairs to pump-house $133.72. During the year ending April 1, 37,831,300 gallons of water were pumped.

ORGANIZATIONS AND INDIVIDUALS

Convention of A. S. M. I.—Indianapolis, the Convention City—Central States Water Works Association—Technical Meetings—F. L. Olmstead—A Visitor From France—Personal Notes

Convention of American Society of Municipal Improvements.

The tenth annual convention of the American Society of Municipal Improvements will be held in Indianapolis, Ind., Oct. 20, 21 and 22. The local committee has arranged a very attractive program for some of the sessions.

On Tuesday morning, Oct. 20, the executive committee will hold a meeting and the opening session of the society will be held in the Commercial Club rooms, 28 S. Meridian-st., at which the address of welcome, the president's address and the annual reports of officers will be presented. On Tuesday evening a banquet is tendered the society. A prominent feature of the program of toasts will be speeches descriptive of the influence of the railroads and the interurban railroads upon the growth of the city. Indianapolis is a noted example of the good effects of both these elements of progress. Other speeches by citizens and members of the society are expected.

On Wednesday afternoon a carriage trip will be taken to exhibit the features

VERMONT STREET, INDIANAPOLIS.
A Wood'en Block Street.

MERIDIAN STREET, INDIANAPOLIS.
A Brick Block Street.

of the city. The interest which members of the society have taken in the wooden block pavements of the city makes them an important part of the constructions to

PRES. C. H. RUST,
City Engineer, Toronto.

be inspected. Other pavements, the new filter and pumping station of the water works, large sewers, sewer trenching machines in operation, sewers and sewage disposal, interurban railways, electric power houses, concrete buildings, will all be on exhibition. A preliminary birds-eye view of the city from the Indiana state soldiers and sailors' monument, 285 feet high, will serve the purpose of consultation of a map.

Thursday night will be devoted to descriptive and technical papers on the engineering features of the city. The sewers, the pavements, the wooden block pavements, the water works, the interurban and city railways, the steam and hot water heating plants, etc., will be described by engineers and superintendents thoroughly familiar with them. Most of these subjects have already been assigned. Indianapolis has model structures in several of these groups and all present valuable object lessons.

Sessions of the convention for the reading and discussion of technical papers will be held on Tuesday afternoon, Wednesday morning and evening and Thursday morning and afternoon. The definite assignment of subjects for these sessions is not issued in time for this number of Municipal Engineering. The committee on sanitation, A. P. Folwell, chairman; on Garbage Disposition and Street Cleaning, John Jones, chairman; on Municipal Data and Statistics, Charles C. Brown, chairman, and on Paving, N. P. Lewis, chairman, have thus far reported valuable papers for the convention and the other committees of the society may be depended upon to do their full duty as they have for previous meetings. The preliminary programs will be sent as soon as printed to any one requesting them from C. H. Rust, president, city engineer, Toronto, Canada; George W. Tillson, secretary, Municipal building, Brooklyn, N. Y., or E. D. Logsdon, vice-president, City building, Indianapolis, Ind.

Indianapolis the Convention City of the A. S. M. I.

The city of Indianapolis has been noted for some years for its rapid improvement and the coincident and perhaps to a considerable extent consequent rapid growth. It entered the tables of the U. S. census in 1840, twenty years later than the city of Buffalo, and a comparison of the

VICE-PRES. A. P. FOLWELL.
Lafayette College, Easton, Pa.

growth of the two cities shows that they increased in population in nearly equal ratios, Indianapolis continuing twenty years behind, but in the later census

IN RIVERSIDE PARK, INDIANAPOLIS.

IN GARFIELD PARK, INDIANAPOLIS.

years showing a pronounced tendency to a higher ratio of increase than its sister city. The advantages of the location of Buffalo in water transportation and large

VICE-FEES. E. D. LOGSDON,
B. P. W., Indianapolis.

tributary area seem to be offset in the case of Indianapolis by its favorable location for the modern methods of transportation. The rapid development of the interurban traffic of the city since the last census and the changes in conditions regarding factory locations promise that the ratio of increase at the next census will still further exceed that of Buffalo at its corresponding age as a municipality.

The new charter of the city of Indianapolis was adopted about twelve years ago, very largely on account of the efforts of the Commercial Club, then a new organization. A very large part of the business advancement of the city is to be attributed to this club, which is always active in promoting the interests of the city. Its rooms are at the service of the American Society of Municipal Improvements for the sessions of its convention, Oct. 20, 21 and 22.

The original plan of the city was very liberal and shows the influence of L'Enfant, the designer of the city of Washington, through one of his assistants, who was employed to design the new capital city of the new state of Indiana in the early part of 1820. The central circle with about three acres area is now the site of the Indiana state soldiers' and sailors' monument, a stately shaft 285 feet high, artistically ornamented. This marks the center of the city and serves as a nucleus for an architectural grouping of public and business buildings, which is gradually developing, receiving large additions at the present time. The original design provided for the state house and county building, symmetrically disposed, and the blocks of state property occupied by the University park and the State Institution for the Blind, which are now balanced by the Union station. The new United States government building adds a new architectural feature in the same north and south line, which should ultimately be balanced by a handsome city hall on the west side of Meridian-st. In the same neighborhood the new tall buildings on the west, including the new terminal station for interurban roads will balance the existing buildings on the east. Thus far the buildings on Monument place have followed symmetrical lines, but the growth of tall buildings on Washington-st. will necessitate some reg-

SEC. GEO. W. TILLSON,
Bureau of Highways, Brooklyn.

ulation of the height of the buildings on the circle at the same time to hide the backs of the buildings on Washington-st. and to keep Monument Place as symmet-

rical and as low in height of buildings as possible.

Our illustrations show a number of the public buildings and business blocks which are notable.

A feature of the city is the great length of handsomely shaded residence streets. Many miles of these have been paved with asphalt, wooden and brick blocks, and macadam. The level area of the city may perhaps be monotonous to those accustomed to rougher country, but it is conducive to uniform growth and to convenience and economy of travel. The difficulties in the drainage of a level area have nearly all been solved, those remaining having sufficient plans, the time

TREAS. F. J. O'BRIEN,
B. P. W., Oswego, N. Y.

for the application of which is now at hand.

A visit to the top of the monument is one of the attractions offered the members of the A. S. M. I. A birdseye view of the business district and of the thickly shaded residence districts is obtained, which shows the beauties of the location and will long be remembered. Some of the accompanying views show streets with various kinds of paving, which at the same time show the architectural features and the convenience of the wide streets in the business district and the beauty and elegance of some of the residence streets.

A trip about the streets is one of the offerings to the meeting of the A. S. M. I. which should be pleasing to its members on account of the interest which they have often expressed, especially in the paving methods of the city. The trip will be extended to include the new filtration plant of the Indianapolis Water Company and its new pumping station. The former is now under construction and in the latter a new pumping engine is being installed. The trip will also include a portion of the park system of the city, which is now quite well extended over the south and the north sides, with a number of smaller parts in the city proper. A good beginning has been made in the eight years since the park commission was established and large plans are in readiness as funds are available for their construction. The latest plan is for a portion of the boulevard system, work on which will probably begin next year.

The city and interurban street car systems are deserving of close study. The city service is confidently presented as more than equal to that in any similar city, and plans for the interurban belt lines and terminal station, construction of which is now under way, are the most comprehensive which have yet been adopted. They are bound to be an important factor in the city's advancement in the near future.

It is scarcely possible to mention the city's manufacturing interests, they are so many and so diversified. Individual members of the A. S. M. I. will be aided to visit any of them.

The hotel accommodations of the city have been largely increased in the past year and will be found eminently satisfactory. Hotel English, on Monument Place, is the headquarters of the society. Other prominent hotels within two or three blocks are the Grand, the new Claypool and the Denison. Many smaller hotels are located on Monument Place and the streets near by.

Pictures are also presented showing the stone-faced concrete, steel arches over Fall creek, and some views of Riverside Park.

Convention of Central States Water Works Association.

The seventh annual convention of the Central States Water Works Association was held in Dayton, O., Sept. 15, 16 and 17. Tuesday was spent in excursions about the city and a banquet at the Soldiers' Home, after a short session for the usual addresses of welcome and reception of reports of officers.

Wednesday was largely given over to

the organization of an association of Ohio Boards of Public Service, the need of which is felt especially since the adoption of the new municipal code governing the cities of the state. Besides the process of organization the convention listened to papers by Dr. C. O. Probst on "The Pollution of Streams in Ohio," which is printed on another page; by E. W. Bemis, superintendent of water works, on "The Adoption of the Water Meter System in Cleveland," and by C. Monjeau. The newly formed society elected as its first board of officers John Stollberg of Toledo as president, H. O. Pond of Columbus as vice-president, and H. M. Andrews of Elyria as treasurer. The organization is independent of the water works association, but will meet with it whenever it meets in Ohio and occupy the sessions of one day.

On Thursday the Water Works Association held a final session at which it listened to a paper on "Proper Care of Pipes and Conduits," by J. R. Maxwell, some extracts from which are given elsewhere in this number, and to one on "The Water Supply of Dayton," by H. J. McDargh, which will also be found on another page. Mr. William Boeh sent a paper on the Cincinnati water supply, W. R. Hill gave some account of the New York City supply, Thos. R. Cook talked about "Repairs to Submarine Water Pipes" and C. W. Wiles gave a history of the association.

Officers for the ensuing year were elected as follows: F. J. Kelley, Cincinnati, president; E. M. Heeger, Evansville, Ind., W. H. Gore, Covington, Ky., J. E. Brady, Chattanooga, Tenn., A. L. Holmes, Grand Rapids, Mich., M. E. McKinney, Wheeling, W. Va., state vice-presidents; W. A. Veach, Newark, O., secretary; Chas. E. Rowe, Dayton, treasurer; C. W. Wiles, Delaware, Geo. F. Cooper, Xenia, Jerry O'Shaughnessy, Columbus, executive committee; T. R. Cook, Toledo, John Langan, Tipton, Ind., A. W. Inman, Massillon, O., finance committee.

Toledo was chosen as the next place of meeting, mainly because the Association of Boards of Public Service desired the further assistance of the Water Works Association in perfecting its organization.

The following are the delegates to the two conventions: William A. Veach,

ILLINOIS STREET MELAN ARCH, INDIANAPOLIS.

Newark, O.; John Langan, Tipton, Ind.; T. R. Cook, Toledo, O.; M. E. McKinney, Wheeling, W. Va.; William Schwertfeger, Wheeling, W. Va.; C. W. Wiles, Delaware, O.; H. J. Putnam, Detroit, Mich.; H. J. Pray, Columbus, O.; George F. Cooper, Xenia, O.; E. D. Lock, Toledo, O.; J. B. Thomas, soldiers' home; John W. Byron, soldiers' home; F. B. Mueller, Decatur, Ill.; George J. Vehter, Youngstown, O.; A. J. Clark, soldiers' home; D. T. Fenner, Cincinnati; M. J. Hartley, Xenia; Frank J. Kelley, Cincinnati, O.; Henry Baxter, Lorain O.; N. Paul Fenner jr., Cincinnati, O.; L. A. Pool, Troy; George N. Carr, Chicago, Ill.; W. R. Hill, New York City; John Stallberg, Toledo; W. B. Mitchell, Piqua; A. Yankstun, Cincinnati, O.; A. D. Otis, Worcester, Mass.; E. F. Mull, Columbus, O.; O. B Mueller, Decatur, Ill; Alba L. Holmes, Grand Rapids, Mich.; Stephen Solar, Cincinnati, O.; J. P. Lamb, Newark, O.; Joseph J. Pater, Hamilton, O.; C. W. Wiles, Delaware, O.; George Wickens, Lorain, O.; James R. Maxwell, Cincinnati, O.; John W. Strackbein, Chicago; F. N. Whitcomb, Chicago; Charles J. Thurman, Evansville, Ind.; E. G. Haeger, Evansville, Ind.; W. E. Sherwood, Evansville, Ind.; J. C. Butte, Steubenville; George Wond, Defiance; C. A. Barton, Zanesville; George J. Vetter, Youngstown; J. E. Crotzer, Zanesville; S. B. Levington, J. B. Lamb, Newark; W. E. Grant, Mt. Vernon; F. B. McNeal, Troy; G. W. Metzger, Springfield; O. S. Watson, G. M. Eidt, Tiffin; J. H. M. Morrison, O. J. Rose, Lima; J. F. Pogue, W. D. McCaughey, Findlay; H. M. Andrews, Elyria; George Wickins, Harry Baxter, Lorain; John Thomas, Lima; John Krause, Mansfield; F. A. Holland, Lima; J. M. Barr, Mansfield; C. C. Marsh, J. J. Kelley, Bowling Green; F. T. Evans, Delaware; J. F. Roye, Bellefontaine; W. A. Pearson, Troy; Henry Amberg, Portsmouth; Edward W. Bemis, Cleveland; H. O. Pond, Columbus; Milton Taylor, Toledo; John D. Nolens, Toledo; Louis Haas, Thomas M. Pexton, Arthur Geisler, Dayton; M. J. Hartley, Xenia; Fillmore Musser, Portsmouth; Frank C. Kay, Findlay; H. Bieder, Ashtabula; B. S. Levering, Piqua; J. H. Clark, Piqua; Charles Krone, Hamilton; J. C. Mather, Hamilton; C. Steinhiller, Greenville; John H. Riling, Marietta; L. B. Levingston, Newark; J. H. Morrison, Lima; W. H. Ferguson, Springfield; C. F. Martin, Bellefontaine; O. S. Watson, Tiffin; George M. Eidt, Tiffin; W. D. Beers, Chicago; E. S. Pettis, Union City, Ind.; A. H. McAlpin, Columbus; G. G. Haship, Sidney; Harry S. Jones, Toledo; C. G. Brown, Toledo; George P. Wohn, Defiance; W. D. Caughy, Findlay; J. F. Pagan, Findlay; E. Hulley, Marion, Ind.; Frank C. Ray, Findlay; Milton Taylor, Toledo; Bernard Groenwald, Toledo; H. Amburg, Portsmouth; P. J Beecher, Toledo; James E. Brady, Chattanooga, Tenn.; W. H. Glore, Covington, Ky.; W. S. Noek, Covington, Ky.; George Y. Banchur, New York City; W. E. Want, Mt. Vernon; Thomas Ford, Cincinnati; J. M. Schlombade, Cleveland; Andrew F. Gregg, Cincinnati; W. F. Glazier, Newport, Ky.; J. L. Lewis, Newark; Filmore Musser, Portsmouth; J. F. Rogge, Bellefontaine; W. L. Reece, Greenville; J. E. Kelly, Bowling Green; S. C. Marsh, Bowling Green; John C. Butte, Steubenville; C. A. Barton, Zanesville; J. E. Crotzer, Zanesville; R. Stone, Lima; George Sweller, Elyria; H. M. Andress, Elyria; James M. Barrett, Mansfield; John Krause, Mansfield; J. M. Ottinger, Columbus; H. O. Pond, Columbus; Charles H. Frank, Columbus; C. O. Probst, Columbus; John Thompson, Lima; Jerry O'Shaughnessy, Columbus; F. B. McNeal, Troy; W. A. Pearson, Troy; Robert B. McGovern, Cincinnati; Edward W. Bemis, Cleveland; George W. Metzger, Springfield; George S. Lambert, Springfield; E. G. Ladd, Chicago; F. A. Holland, Lima; John Thomas, Lima; O. J. Rose, Lima; H. C. Klippinger, Delaware; J. S. Nolen, Toledo; H. Bieder, Ashtabula; B. S. Levering, Piqua; J. H. Clark, Piqua; Charles Krone, Hamilton; J. H. Clark, Hamilton; J. C. Mather, Hamilton; C. Steinhiller, Greenville; Harry Thompson, Hamilton; C. Monjeau, Middletown, John H. Riley, Marietta; E. C. Humphrys, Cincinnati; G. A. Weast, Springfield; William T. Kount, Springfield; D. W. Sinks, Troy.

Technical Meetings.

The ninth annual convention of the Ohio Electric Light Association will be held at Columbus, O., Oct. 13, 14 and 15.

The twenty-second annual convention of the New England Water Works Association was held at Montreal, Canada, Sept. 9 to 11. George W. Janin, superintendent of water works, and T. W. Lesage, assistant superintendent of water works, each presented papers on the Montreal water works, accompanied by lantern slides. Superintendent Janin's paper was historical and descriptive and Mr. Lesage's paper described the development of service boxes in Montreal.

Frank L. Fuller of Boston presented a paper on "Covering the Natick Reservoir with a Concrete Floor." William R. Hill read a paper for Mr. Venner of Syracuse on "The Use and Waste of Paper by Public Schools at Syracuse, N. Y." Frank C. Kimball, superintendent of the Knoxville Water company, sent a paper entitled "Some Six-Inch Meter Tests and How They Were Made." The paper, which was valuable, was distributed and attention to different points contained in it was directed by C. W. Sherman. F. H. Crandall of Burlington, Vt., chairman of the committee on "Apportionment of Charges for Private Fire Protection and the Means of Controlling the Supply Therefor," stated that the committee had had no opportunity to confer with insurance men and that it was still investigating devices submitted for the control of private fire pipes. The committee submitted a brief report, which was adopted. The filter plant at Lawrence, Mass., was described with the aid of lantern slides by M. F. Collins, superintendent of water works at Lawrence. John A. Hall of Quincy, Mass., read a paper on "Reciprocal Obligations of the Management of a Water Supply and the Community."

The annual convention of the American Gas Light Association will be held in Detroit, Mich., Oct. 21 to 23. A. E. Forstall, Secy., 58 William-st., New York City.

The civil engineers, engaged in municipal work in Texas, held a meeting at Ft. Worth, Sept. 7 and 8 and formed the Texas Engineering Society, with J. B. Hawley of Ft. Worth as president.

The Connecticut Society of Civil Engineers has abandoned its plan for publishing its papers and discussions in an annual volume of proceedings, and will hereafter publish a periodical bulletin, each number of which is to contain papers and other matter prepared by members and which will thereby bring these papers before the society at large. The first number of this periodical form appeared in August. J. F. Jackson, Secretary, New Haven, Conn.

The seventh annual convention of the League of American Municipalities will be held at Baltimore, Md., Oct. 7, 8 and 9, 1903. The program, so far as arranged, is as follows:

Address of Welcome—The Hon. Robert M. McLane, Mayor, Baltimore, Md.

Response—The Hon. J. Adger Smyth, President and Mayor of Charleston, S. C.

"Municipal Telephones"—Mr. J. F. Hemenway, New York City.

"The Advantages of Municipal Construction Over the Contract System"—The Hon. James M. Head, Mayor, Nashville, Tenn.

"Municipal Ownership of Public Utilities"—The Hon. James A. Reed, Mayor, Kansas City, Mo.

"The Initiative and Referendum"—Mr. George Shibley, Chairman National Federation for Majority Rule, Washington, D. C.

"The Operation of a Municipal Asphalt Plant"—The Hon. John Arbuthnot, Mayor, Winnipeg, Canada.

"Organized Labor and the Municipality"—The Hon. Ignatius A. Sullivan, Mayor, Hartford, Conn.

"Water Waste"—Mr. E. W. Bemis, Superintendent of Water Works, Cleveland, Ohio.

"Paving"—Mr. A. W. Dow, Ph. B., Inspector of Asphalt and Cements, Washington, D. C.

"Municipal Statistics"—Mr. Hugo S. Grosser, Municipal Statistician and Librarian, Chicago, Ill.

"Garbage and Sewage Disposal"—Mr. Rudolph Hering, Hydraulic Engineer and Sanitary Expert, New York City.

"The Ideal City"—Prof. Frank Parsons, Mt. Holly, N. J.

"Municipal Restriction of the Social Evil"—Hon. Julius Fleischmann, Mayor, Cincinnati, O.

It is expected that in addition to the above the convention will be favored by a paper on the negative side of municipal ownership, by Mr. Ernest H. Davis, Secretary of the National Electric Light Association; a paper, "Acetylene Gas Lighting by the Municipality," by Mr. Nelson Goodyear, New York City; an address by Hon. Charles J. Bonaparte, President of the National Municipal League, Baltimore, Md.

Among those who have indicated an intention to be present and take part in the discussion of the papers presented are Hon. John Weaver, Mayor, Philadelphia; Hon. Samuel M. Jones, Mayor, Toledo, O.; Hon. George D. Locke, Mayor, Jerseyville, Ill.; Hon. W. M. Drennen, Mayor, Birmingham, Ala.; Mr. L. W. Rundlett, Commissioner of Public Works, St. Paul, Minn.

Frederick Law Olmstead.

Mr. Frederick Law Olmstead, the noted landscape architect, died at Waverly, Mass., August 28, aged eighty-one years. He was born at Hartford, Conn., April 27, 1822. He studied agricultural science and engineering at Yale, but never graduated. He spent several years at practical farming at Saybrook, Conn.,

and Staten Island, N. Y. He made several trips afoot and horseback, through Europe, Great Britain and the Southern States examining landscape architecture. Accounts of these journeys are given in "Walks and Talks of an American Farmer in England," "The Seaboard Slave States," "A Journey Through Texas," and "A Journey to the Back Country." In 1856, the city of New York purchased the site of Central park for about $5,000,000 and asked for plans for its improvement. Designs were filed by thirty-three competitors, and that of Olmstead and Vaux was adopted, and they were engaged as landscape architects. With the assistance of Mr. Vaux he designed the improvements for Prospect park, Brooklyn, the park system of Buffalo, the Massachusetts Metropolitan park system, the South parks of Chicago, Riverside and many other large and small parks in Los Angeles, Milwaukee, Kansas City, Louisville, Montreal and other cities. He also planned the grounds about the capitol at Washington, including the marble terrace and stairway, the park at Niagara Falls, the state house grounds at Hartford, and the World's Fair grounds at Chicago.

American Sanitary Methods Under Inspection.

The secretary of the Paris water and sewer commission, Mr. Max Le Couppey de la Forest, visited Indianapolis the first part of September for the purpose of studying the water supply system, sewers and garbage disposal and the sewage disposal plant at the Boys' Industrial school at Plainfield. He visited twenty other cities in the United States before reaching Indianapolis. He then went to St. Louis and from there to Ogden, Utah, to attend the national irrigation congress, to Denver, and on his return will stop at St. Paul, Chicago, Toledo, Cleveland, Canton, Alliance, Warren, Lorain and Mansfield, O. While in Indianapolis he said:

In Paris we have two kinds of water—drinking water and cleaning water. In every street and every house there are two sets of pipes, one for drinking water and the other for cleaning water. The former kind of water is used not only for drinking purposes, but in the preparation of all varieties of foodstuffs, while the cleaning water, as the name indicates, is used entirely for cleansing purposes, flushing the streets, etc. Our drinking water is derived entirely from five springs and brought to the city through immense aqueducts. These springs are located at different distances from Paris, one as far as 150 miles away. The next spring that will be used is situated about 200 miles from Paris. One of the sources of our drinking supply—the Vanne spring, ninety-five miles distant from the city—has a capacity of over 30,000,000 gallons of water a day. It is really a group of about ten very excellent springs. The physicians within a radius of every spring drawn upon by Paris report to my office promptly every case of typhoid, dysentery and kindred diseases. I either go myself or send an assistant to disinfect the surroundings and to take every precaution to prevent a contamination of our water supply. The physicians are paid handsomely by the city of Paris for these reports. Our next step will be to construct a filtration plant to furnish drinking water for the suburbs of Paris and that is why I have come to Indianapolis and other American cities to secure information. Our cleaning water is taken from the River Seine.

Mr. Forest was very much impressed with the large tracts of uncultivated territory in America and said that "in France there is hardly an inch of soil that is not utilized."

Personal Notes.

H. P. Cumings has been elected city engineer at Painesville, O.

Benjamin T. Fendall has been reappointed city engineer at Baltimore, Md.

Stephen Childs, C. E., has established an office at 2 Park-st., Boston, Mass.

H. I. Reed, C. E., has established offices in the Out West Building, Colorado Springs, Colo.

Frank P. Rice has been elected president of the board of water commissioners at Atlanta, Ga.

Mr. Irving A. Chandler has returned to the New York office of the Engineering Company of America.

W. G. Kirkpatrick has resigned as city engineer at Jackson, Miss., which position he has held for six years.

E. B. Raymond has been appointed general superintendent of the Buffalo plant of the General Electric Company.

F. C. French has been appointed assistant professor of civil engineering in the Iowa State College, Ames, Ia.

W. Edward Wilson has been appointed associate professor of civil engineering at the University of Utah, Salt Lake City.

John E. Phillips of Denver has returned to the West on business for the Engineering Company of America, New York City.

Dr. Joseph Hyde Pratt of the Engineering Company of America has returned to New York City after doing some work in North Carolina.

L. J. Wagner has resigned as superintendent of water works at Rome, Ga., to accept a position as chief engineer of the Gulf Compress Company.

Percy S. Smith has resigned as a civil engineer in the office of F. A. McClure, city engineer at Worcester, Mass., to become associated with Arthur C. Moore,

C. E. of Southbridge, with offices in the Taylor building, Worcester.

Dr. Milo R. Maltbie, assistant secretary of the Municipal Art Commission, New York City, returned from a two months' visit to European cities Sept. 3.

Mortimer R. Miller has resigned his position in the city engineering department at Rockford, Ill., to accept one as assistant city engineer at Waukegan, Ill.

Hiram A. Miller, M. Am. Soc. C. E., has been appointed chief engineer of the Charles River Basin Commission, Boston, Mass., with offices at 367 Boylston-st.

Herman Nieter, representing the Engineering Company of America, is taking a trip to Cleveland, Chicago and the intermediate points in the central west.

Joseph A. Bond has resigned his position as superintendent of water works at Wilmington, Del., which office he has held for twenty years, and on Sept. 1 was succeeded by Theodore A. Leisen, M. Am. Soc. C. E.

John L. Howard, M. Am. Soc. C. E., has been appointed division engineer in charge of outside work by Hiram A. Miller, chief engineer of the Charles River Basin Commission.

R. J. Hickey, sewer contractor, and Mr. Schunke of the city water department, Milwaukee, Wis., were overcome by gas in the North-ave. sewer, Sept. 1, and died from its effects.

Norman C. Spencer and Albert L. Washburn of the city engineering department, Hartford, Conn., have formed a partnership to be known as Spencer & Washburn, and will conduct the engineering business established by Clarence B. Vorce, who recently connected himself with the John F. Kelly Engineering Company of New York City.

S. E. Killam has been promoted to city engineer, in charge of the general office work in the office of the Metropolitan Water Works Company, Boston, succeeding John N. Ferguson, resigned.

Dr. Oskar Nagel has established an office and laboratory at 90 Wall-st., New York City, where he will practice chemical engineering, chemical technology and the utilization of waste products.

Prof. Henry B. Dates, professor of electrical engineering at the Clarkson School of Technology, Potsdam, N. Y., has been appointed professor of electrical engineering at the University of Colorado.

M. W. Cooley, M. Am. Soc. C. E., has been appointed general manager of the New Trinidad Lake Asphalt Company, Ltd., of Port of Spain, Trinidad, B. W. I.

A. A. Morris has resigned his place as city engineer of Billings, Mont., to engage in business in Seattle, Was.

H. J. Westover, mechanical engineer, has associated himself with the Engineering Company of America, New York City. Mr. Westover makes a specialty of reducing operating expenses in established plants and of designing and laying out new plants so as to operate with the greatest economy.

Mr. C. R. Guertler, who is in charge, for the Engineering Company of America, of the power house work on the Copper Cliff smelter of the Canadian Copper Company, is going to Copper Cliff to complete the work there and will be accompanied by Mr. C. W. Weller and Mr. Edward Torrey, who go as his assistants.

MACHINERY AND TRADE

The New Bituminous Filler for Block Pavements.

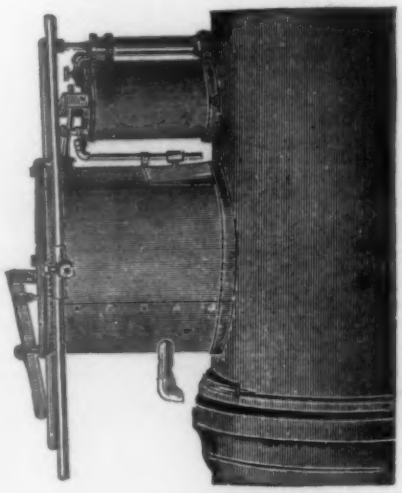
The National Bitumen Company, which has heretofore maintained its principal office at 78 La Salle-st., Chicago, has removed the main office to Indianapolis. Up to the present time the company has made no effort to supply its bitumen in commercial quantities, but has only sought to get samples of its material in the hands of engineers, municipal authorities, paving contractors and other persons looking for an ideal paving filler. The officers of the company say that no engineer who has made any of the usual tests with samples of national bitumen has failed to find it meeting all the claims made for it by the company. A large number of letters have been received by the company from engineers in various parts of the country, all giving strong commendation to the new bitumen. One engineer writing from an eastern city said that, while it was not included in their specifications, he had strongly recommended its use to a contractor having a contract for laying eight blocks of brick pavement and would use every effort to have it used in this work because he had subjected it to the most

severe tests he knew and found it superior to anything he had ever tested.

The statement by the company that national bitumen would retain its pliability at 8 degrees below zero and would not run at 200 degrees has been confirmed by tests by individual engineers. In addition to its stability under variations in temperature it is claimed for the national bitumen that it is not subject to oxidation upon exposure and thus retains its resiliency and imparts it to a pavement. The three objections usually made against granite pavements are their rigidity, noise and resistance to traction on account of uneven surface. It is claimed that if smoothly dressed blocks are laid with national bitumen as a filler all these objections are minimized, thus allowing the durability of granite to receive its due consideration for paving purposes.

A New Lead Melting Pot.

We present herewith an illustration of a lead melting pot intended to supersede the coke-burning furnace familiar to everybody. The latter must be kept on



A LEAD-MELTING POT.

the bank and the melted lead be brought in ladles to the joint to be poured, so that the lead is often too cool for satisfactory pouring. On large pipes or in deep trenches an appreciable amount of time is lost at each joint owing to these conditions. The new apparatus sits directly on top of the pipe and has a spigot projecting over the top of the bell. Consequently the lead can be run just as soon as the clay roll or jointer is in place. It is only necessary to raise the operating lever and let the molten lead flow into the joint until it is full.

The apparatus consists of the melting pot proper and a gasoline tank with an air pump to keep up a pressure on the gasoline. This air pressure forces the gasoline into pipes about the pot; the pipes are drilled with small holes which act as jet burners and can be made to furnish a steady, intense heat applied just where it is needed. The lead pot and gate are so arranged that there is no waste of lead in pouring the joints, as is often the case where hand ladles are used by careless workmen, and the lead is delivered in a steady stream of high temperature which renders improbable the occurrence of seams and hollow places in the joint.

The apparatus is made in two sizes by the Contractors' Plant Company of Boston. Size 1 is for pipe up to 36 inches diameter and No. 2 is for larger pipe. The makers state that on several occasions two men with a No. 1 melter and a jointer have done all the work on 100 joints of 36-inch pipe in ten hours. One hundred pounds of lead per joint was employed as a rule, and the day's work required four gallons of gasoline. The pot is said to be very economical for any pipe above 8 inches in diameter. It can be used on the largest pipe made.

Concrete Buildings for Railway.

The Minneapolis and St. Louis Railroad is building a 15-stall roundhouse at Albert Lea, Minn., and a freight depot at Ft. Dodge, Ia., of concrete blocks. The blocks are made of Portland cement and gravel in such proportions that one barrel of cement produces 15 blocks 10 inches wide, 9 inches high and 30 inches long. The gravel runs about 50 per cent. sand. The blocks are manufactured at the building site and after attaining a permanent set are kept in the open air with frequent sprinkling of water for 10 days, after which they are considered fit for use in the work. They can be made in three sizes upon the same machine—either 6, 8 or 10 inches wide, and with either plane face or rock face, as shown in the detail illustration to which reference may be made.

In laying the blocks the large central hollow spaces are left open to reduce weight and provide continuous air space, but the small pockets at the ends where the blocks join in breaking joints are filled with mortar. This serves as a key to lock the wall and complete the bond,

and also prevents the admission of air through a defective vertical joint.

Attention is called to one particular feature of this type of block which is of importance in construction, viz.: In making the blocks for the top course of a wall or story the cores in the machine in which they are manufactured can be withdrawn to any desired distance below the top of the block and the blocks thus finished with a solid top of any required thickness. The work upon the roundhouse is in progress, presenting a sightly appearance, and it is stated that the cost is found to be less than in the use of good, hard burned brick.

The Normandin cement-concrete block machine, made and sold by the Cement Machinery Company of Jackson, Mich., is

NORMANDIN HOLLOW CONCRETE BLOCKS.

used in making the blocks used in these buildings.

The accompanying cut shows several varieties of faces for standard blocks, also, string courses, window casings, ornamental courses, corbels, etc.

American Asphalt Machinery Abroad.

The F. D. Cummer & Son Company of Cleveland, O., manufacturers of the Cummer dryers and asphalt machinery, recently supplied a semi-portable asphalt plant to the Hungarian Asphalt Company of Budapest, Hungary, having a capacity for laying 1,500 square yards of 2-inch topping in a ten-hour day.

The following extract from a letter by D. Szende, the manager of the Hungarian Company, shows the reception which was given the machine:

"I confirm my cable of the 14th inst., containing the word 'Peach,' this being the message we agreed on to convey to you that the semi-portable asphalt plant you supplied us with in April last has got satisfactorily started and now I wish to add that she is a perfect daisy, admired by every expert who has seen her, and running as smooth and nice as clockwork, with a capacity much superior to the one she was contracted for."

Trade Publications.

Paving, roofing and insulating materials are catalogued in a pamphlet of the Trinidad Asphalt Manufacturing Company of St. Louis, Mo.

Charles Warner Company of Wilmington, Del., New York and Philadelphia issue a unique illustrated statement of the fact that there is "no core" in Cedar Hollow Lime, accompanied by a report of tests of mortar made of "limoid" and cement, which has heretofore appeared in this magazine.

Thacher patented bars for concrete steel construction are scientifically treated in a pamphlet issued by the Concrete-Steel Engineering Company, Park Row Building, New York.

Buildings of Sand Brick.

In a recent issue of this publication we have had occasion to describe bricks made by the "Huennekes System." These bricks are used in the construction of the buildings represented by the two accompanying half-tones. The engravings furnish ample proof of the excellent appearance of the buildings constructed of these bricks; not only does the work pos-

SCHOOL BUILDING, BENNETSVILLE, S. C.
Built of Huennekes System Bricks.

sess a solid appearance but as the illustrations show a very fine finish also.

Such progress has been made in this industry that in the United States alone not less than twenty-five factories for the manufacture of these bricks are either in actual operation or in course of construction by the firm of H. Huennekes & Company, 114-118 Liberty-st., New York, N. Y.

Trade Notes.

ASPHALT.

The Asphalt Mining Company of Indian Territory has decided to rebuild the buildings recently destroyed by fire. Prest. Billings.

The plant and machinery of the Loco Asphalt Company, thirty miles west of Ardmore, I. T., were totally destroyed by fire Aug. 24, entailing a loss of $60,000.

The question of purchasing an asphalt plant of the Blake Economic Asphalt Heating Company, of Denver, Colo., is being considered by the city officials of Grand Rapids, Mich.

The American Standard Asphalt Company, of Logan county, Kentucky, is being reorganized with increased capital, according to press reports. The company's Louisville office is located at First and A-sts.

BRICK.

The Electric Brick and Fuel Company Aledo, Ill., has been incorporated by Benjamin F. Townsley, John Kearns and Chas. W. Smith.

The Independence Shale Brick Company, Kansas City, Mo., has been incorporated by J. O. Edson, C. M. Sturgis, J. F. George, W. E. Peck and E. A. Schocier,

The National Sand Lime Brick Company has been incorporated by C. J. and J. A. Larsen to manufacture artificial stone and brick. The company's plant will be located at the Ten Mile Hill, near Chattanooga, Tenn.

The Ohio & Michigan Paving and Pressed Brick Company has been incorporated and has purchased the Lane brick plant at Trimble, O. James D. May and James P. Cummiskey of Detroit, Mich., are interested.

The New River Sandstone Brick Company, Bramwell, W. Va., has been incorporated by H. S. Brown of Bramwell, W. Va.; J. E. Jones, Switchback, W. Va.; Harry Bowen, Bramwell; W. Wyndham Stokes, Welch, W. Va.

The Monroe Brick Company, Woodsfield, O., has been incorporated to manufacture and sell common building and paving brick, by W. E. Mallory, J. W. Alderson, J. W. Morris, J. M. Bishop and W. C. Mooney of Woodsfield.

CEMENT.

The Jones Fire Brick and Cement Company, Augusta, Me., has been incorporated to manufacture brick and Portland cement. F. L. Dutton is president and E. F. Whittum is secretary of the new company.

The Olympic Concrete Construction Company, Seattle, Wash., has been incorporated.

The new plant of the Hudson Portland Cement Company, Hudson, N. Y., has been in operation since the middle of July.

The contract for cement for a $400,000 hotel to be erected at San Diego, Cal., was awarded to the American Hydraulic Stone Company of Denver.

The International Cement Company, Elizabeth, Pa., has begun the manufacture of Portland cement out of the waste product of blast furnace slag, according to press reports.

E. P. Roberts & Co., Cleveland, O., consulting engineers, have opened a department of cement engineering and will design and supervise the construction and operation of cement plants.

The rights for Cook county, Illinois, to use the H. S. Palmer hollow building block machines have been sold by the H. S. Palmer Building Block Company of Washington, D. C., for $60,000, including twenty-five machines.

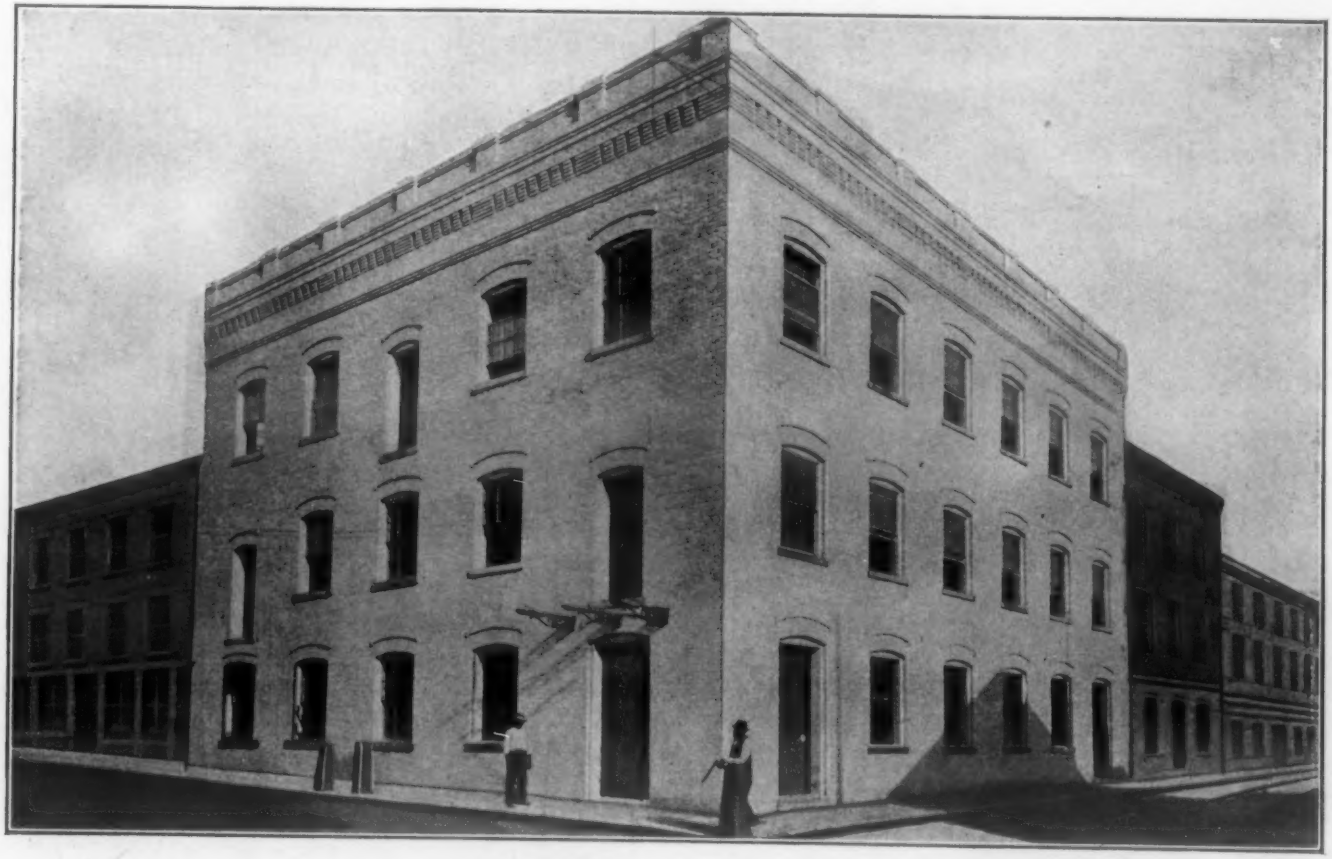
The plant of the Lancaster Concrete Block and Paving Company is nearly completed. The building is 102 feet long, 36 feet wide and 9 feet high, and is constructed of concrete blocks. Aaron Burgner is interested.

Surveys have been made for building a cement plant north of Bedford, Ind., on the Gardner addition, and also on the Gunn farm west of Bedford. The company will be composed largely of local capitalists who are now identified with the stone quarry industry.

The Utica Cement Brick and Block Company, Utica, Mich., has been incorporated to manufacture cement brick and hollow concrete building blocks. The officers of the company are: President, George B. Davis; secretary, E. Corless Kelly; treasurer, E. J. LaMontaine.

The International Portland Cement Company, limited, Hull, Canada, has awarded contracts for the structural steel work of the new plant. The directors of the company are W. F. Cowham, president; A. F. MacLaren, vice-president; Dr. D. Jamieson, treasurer; D. W. Stanhope, secretary; J. S. Irwin, business director.

M. E. Sullivan, Longmont, Colo., is interested in the subject of the manufacture of Portland cement. He has an unlimited quantity of limestone and shale, located on the railroad, close to coal mines, surrounded by timber and on river bank, and within fifty miles of Denver. The limestone and shale has been tested by experts who state that it will make a very excellent cement. Mr. Sullivan desires to interest capital in the proposed erection of a cement plant.



WAREHOUSE, WILMINGTON, N. C.
Built of Huennekes System Bricks.

LIGHTING AND POWER.

The Indiana Hydraulic Power Company, Peru, Ind., has been incorporated by Jos. Andres, Wm. Hart and Frank Carter.

The Acetylene Light Company, West Terre Haute, Ind., has been incorporated by R. M. Hollingsworth, E. L. Sweet and John S. Hunt.

The Eureka Electric Light Company, Eureka, Utah, has been incorporated to furnish light and power. W. B. Searle, president; A. L. Woodhouse, secretary.

The St. Charles Lighting Company, St. Charles, Minn., has been incorporated by M. J. McGrath, of Winona; Charles F. Knapp, Herman Canfield, Thomas Schock A. G. C. Raben, of St. Charles.

The New York sales offices of the Nernst Lamp Company have recently been removed from the Equitable building and transferred to the new Hanover Bank building, No. 11 Pine-st., New York City.

Newly incorporated lighting companies: Royse-Batley Electric Company, Indianapolis, Ind.; New Castle Light, Heat and Power Company, New Castle, Ind.; Detroit Gas, Light and Coke Company, Detroit, Mich.; Porto Rico Railway, Light and Power Company, Camden, N. J.

The Cumberland Transportation, Light and Power Company, Norton, Va., has been incorporated to build an electric railway from Norton to Tom's Creek, thence to Wise. The incorporators are Henry M. Smyth, R. W. Dickenson, E. M. Fulton, W. H. C. Bond, J. B. Ayers, E. H. Ould, T. E. S. Bailey, Dr. M. L. Stallard, C. F. Flanery, R. Tate Irvine, O. M. Vicars, John A. Esser and R. L. Brown.

MISCELLANEOUS.

St. Paul, Minn.—Bids are asked until Oct. 5 for furnishing a stone crusher. Geo. T. Redington, Secy. bd. park comrs.

The Huastica Development Company, Camden, N. J., has been incorporated to supply water for irrigation, mine and domestic purposes by S. J. MacFarren, John P. Graham, W. C. Dunke, W. S. Peters, R. C. Machesney and W. F. Rice.

The Sea Shore Bridge Company, North Beach Haven, N. J., has been incorporated by Robert P. Browne, Philadelphia; A. P. Willits and Joseph B. Willits, T. Fernley Brooks, Philadelphia. The company will build bridges, viaducts, tunnels, wharves, etc.

Recent Inventions.

723,238. March 24, 1903. Water Filter. J. W. Burns, Terre Haute, Ind. A collapsible can for unfiltered water in a can for filtered water with filtering material between and spring for collapsing the inner can.

723,307. Mar. 24, 1903. Tunnel Construction.—Jesse W. Reno, New York City. A segmental tunnel shell joined by anchor rods to a heavy concrete girder underneath reinforced with steel tension rods at its bottom.

723,318. Mar. 24, 1903. Garbage Vault or Receptacle.—Edward L. Schiefer, St. Louis, Mo. A metallic vault with inlet door on top and outlet door on side and ventilator on top, with disinfectant in pan, through which air from vault must pass.

723,494. Mar. 24, 1903. Cement and Artificial Stone Composition.—A. C. Schulz, Detroit, Mich. A hydraulic cement made of burnt clay, pulverized gravel and lime.

723,612. March 24, 1903. Water Closet. Henry O. Krakow, Dubuque, Ia. A flushing appliance for use directly on water pipe without tank.

723,619. March 24, 1903. Road Scraper. J. D. Olcott, Norwalk, O. A complicated machine with many claims.

723,887. March 31, 1903. Wheeled Scraper. W. S. Livingood, Kansas City, Mo. An axle, pan and end-gate, with arms rigidly attached to gate and pivoted on pan with chain to keep end gate up when pan is dumped and means to operate.

723,959. March 31, 1903. Apparatus for Cremating Putrescible Waste Materials. W. W. Wheildon, Boston, Mass. A hopper in which garbage may be deposited, and feed drums with elastic fingers and comb-teeth connecting hopper with water jacketed feed pipe, having a drip pipe in use when feed pipe is closed; rotary furnace fed from feed pipe, stationary furnace with permanent fire and a secondary grate adapted to receive unconsumed material dropping from lower end of inclined rotary furnace and consume it; also means for drawing air through the storage tank into the cremating apparatus.

724,018. March 31, 1903. Protractor. C. L. Kline, Chicago, Ill. Blade with pivoted protractor segment of spaced connected plates on opposite sides of blade, clamps and means for adjusting them, with indicator point, and flanged edge.

724,042. Mar. 31, 1903. Machine for Making and Repairing Roads. J. B. Rhodes and B. O. Rhodes, Barberton, O. Rear wheels on separate axles adjustable longitudinally, the wheels being on the short arms of pivoted axles movable by chains at end of long arms.

724,146. Mar. 31 1903. Extensible Centering-Support. G. B. Waite, Hoboken, N. J. For supporting concrete in construction of floor arches and the like from the lower flange of floor beams for various lengths of span.

724,165. Mar. 31, 1903. Composite Railway-Tie. J. C. Currier, Salix, Iowa. Two rectangular blocks of artificial stone with bolt holes to bolt on a steel plate for spacing them apart, which has nut-locking and rail-holding lugs.

724,286. Mar. 31, 1903. Road-Bed. Isaac Haws, Hannibal, N. Y. Concrete blocks with concave track ways in center of top surface and centered mortises and tenons at ends for joining blocks together.

724,461. Apr. 7, 1903. Construction of Concrete Buildings and Nail-Plug There-

for. F. W. Garretson, Baltimore, Md. A nail-plug for use in a reinforced concrete floor with holes and shield for covering them.

724,462. April 7, 1903. Construction of Concrete Buildings. F. W. Garrettson, Baltimore, Md. Reinforced concrete beams or columns with bolts through the metal which extend outside of concrete for securing studding, partitions, etc.

724,500. April 7, 1903. Truss. A. A. Raymond, Chicago, Ill. Concrete slab or girder with plane upper surface and convex lower surface parallel with curved rods embedded in the concrete and having nuts and washers or other enlargements at ends. Slabs are made separately and set on supports as desired.

724,608. April 7, 1903. Machine for Molding Artificial Stone. Noyes F. Palmer, Brooklyn, N. Y. A slotted mold with slotted false bottom, plunger carrying partitions and means for operating them independently.

724,650. April 7, 1903. Machine for Clearing Fields, Roads or the Like. Julius Zobel, Juliusburg, Germany. Frame with attached cutting knives in zig-zag line, driving wheels and drum operated by them.

724,762. April 7, 1903. Third Rail Electric Railway System. W. G. Wagenhals, Cincinnati, O. I-beam conducting rail invertable when worn, supporting chairs, continuous protecting cover with depending sides secured to chairs, insulating blocks grooved for rail and supported on re-entering flanges of sides of cover.

724,866. April 7, 1903. Expanded Metal Structure. G. J. Holl, Cleveland, O. Having diagonally arranged ribs or expanded portions extending from junctions, each rib having a longitudinal corrugation, alternately in opposite directions.

724,898. April 7, 1903. Garbage Furnace or Crematory. E. J. Little, G. H. Breymann and D. C. Shaw, Toledo, O. Elongated chamber and grating therein with arch above forming a receiving and drying chamber above the arch, furnaces at inlets of the chambers above and below the grating, return flues in the drying chamber, a supplemental furnace in the connection between lower chambers and return flues with stench bars above it and flues leading from the upper chamber into the supplemental furnace under the stench bars.

725,038. April 14, 1903. Device for Building Cement or Concrete Structures With Hollow Walls, Flues, Etc. W. H. Cadwell, Wayne, Mich. An open-ended tube of sheet metal with free overlapping portions and a bar attached to one portion, adapted to contract the tube for drawing it out after a removable core has been withdrawn.

725,098. April 14, 1903. Form or Center for Molding the Inverts of Concrete Conduits. W. F. Learned, Watertown, Mass. Cradles supporting invert forms, the cradles being removable after concrete is deposited without removing form, which is in two parts, the upper part being supported on the lower part while the concrete is deposited outside it.

725,275. April 14, 1903. Soil-Pipe Connection. Joseph McLean, South Manchester, Conn. A section having a seat for a ferrule, a ferrule to fit the seat, a surrounding thimble, a pipe end and a coupling to form a tight joint and force the thimble tightly to its seat.

725,544. April 14, 1903. Strengthened Cast Cement. Joseph Daime, Marseilles, France. A semi-cylindrical bottomed trough with vertical side walls made of cement with embedded network, the bottom being thicker than the sides.

725,608. April 14, 1903. Metal Sheet Piling. Henry Wittekind, Chicago, Ill. Z-beams with intermediate compound sections having channels to receive the side flanges of the Z-beams.

725,641 and 725,642. April 14, 1903. Apparatus for Grading Minerals and Preparing Mineral Ingredients of Bituminous Macadam or Other Pavements for Use. H. W. Ash, Cambridge, Mass., assignor to Warren Brothers Company, Boston, Mass. A rotary drying and heating drum with means for delivery to and from, rotary grading screen of sections with perforations of different sizes, bins to receive the different sizes of stone therefrom, with discharge gate for each bin to deliver definite quantities to mixer below.

725,693. April 21, 1903. Apparatus for Preparing Composition for Artificial Stone, Bricks, etc. Lewis P. Ford, Gresford, England. Lime and sand automatic measuring devices, elevator to carry to hopper of a mixer with heating jacket to drive off surplus moisture and having a tubular outlet with a cooling jacket; including means for operating all.

725,751. April 21, 1903. Caisson or Coffer-Dam. Daniel E. Moran, Mendham, N. J., and E. S. Janett, New York City. Adjacent caissons having adjustable outward projections forming a pocket between them permitting extension of periphery of caissons and calking tight.

725,770. April 21, 1903. Composite Post. Abraham E. Probasco, Warren county, Ohio. Shell of vitrified pipe, concrete filling with metal straps embedded and projecting to hold wooden upright.

725,914. April 21, 1903. Rail-Block. W. H. Arthur, Stamford, Conn. A block with a toe extending to the web of the rail and formed to leave a space between the rail and the upper portion of the block which has an inclined shoulder connecting with the toe and is rabbeted laterally.

727,011. May 5, 1903. Crematory for Garbage or Like Substances. F. P. Smith, Albany, N. Y. A main central chamber with furnace, trunks, having upper and lower sections, extending from and connecting therewith, the upper sections to receive garbage to be dried and thence dropped to lower section to be burned, with proper controlling valves to turn gases as desired.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Nashville, Tenn.—The Nashville Ry. & Light Co. will pave between its tracks and two feet on each side on S. Spruce-st., from Broad to Gleaves, with Warren Bros.' bitulithic pavement. Woodland-st. is being paved with bitulithic pavement.

Springfield, Ill.—The supreme court of Illinois will be asked to pass upon the question of resurfacing Fourth-st., from Madison to Jackson. It is alleged that the resurfacing of the street would be of no decided benefit to the property-owners.

Morristown, N. J.—A writ of certiorari was issued by Justice A. Q. Garretson of the supreme court Sept. 19, granting a review of the resolution of the board of freeholders of Morris county, providing for making contracts for broken stone for county roads. The writ was made returnable Oct. 3. The contract for stone was awarded to Fred W. Schmidt, and it is claimed that the resolution of the board awarding the contract does not conform to the authority conferred by the board upon the road committee.

CONTEMPLATED WORK.

Toulon, Ill.—The construction of concrete walks is contemplated.

Lake Mills, Wis.—Macadam paving is proposed. N. Folk, cy. clk.

Youngstown, O.—The property-owners on Nimrod-ave. have petitioned for paving.

Albany, N. Y.—An ordinance has been passed to pave Clinton-ave. with macadam.

Muscatine, Ia.—Paving is contemplated next year for a large list of streets.

Springfield, Ill.—The property-owners on S. Second, Laurel and First-sts. have petitioned for paving.

Lockport, N. Y.—The residents on Washburn-st. will circulate a petition asking for a better pavement.

Bakersfield, Cal.—Asphaltum rock and sand paving is contemplated for L-st. A. T. Lightner, cy. clk.

Pine Bluff, Ark.—Asphalt or brick paving is contemplated for State and Barraque-sts. and Second-ave.

Brookline, Mass.—Washington-st. will be paved with bitulithic pavement, according to press reports.

Seattle, Wash.—Council passed an ordinance Sept. 17 for constructing 28 miles of sidewalks in Green Lake.

Redlands, Cal.—Plans will be prepared for paving all of the streets in the business district with brick.

Wausau, Wis.—The property-owners on Jefferson-st. between Main and Third have petitioned for macadam paving.

West Bay City, Mich.—Cy. Engr. Thompson will submit estimates of the cost of paving seven blocks of S. Henry-st.

Watertown, N. Y.—Belgian block or brick paving is contemplated from Factory-st. C. O. McComb, cy. engr.

Lancaster, O.—A resolution was adopted Sept. 17 to ask for bids for paving Wheeling-st., from High to Maple.

Alton, Ill.—The village council of Upper Alton passed ordinances Sept. 15 for paving Broadway and Liberty-sts.

Providence, R. I.—Bids will probably be asked for asphalt and Warren Bros. bitulithic paving for Branch-ave.

Lynn, Mass.—Street improvements are proposed.

Pueblo, Colo.—A boulevard nine miles long is proposed.

Winona, Minn.—Plans have been prepared for paving Walnut-st.

Cambridge, Mass.—Paving is contemplated for Massachusetts-ave.

Chaska, Minn.—A brick or tile walk on Fourth-st. is contemplated.

Monroe, Wis.—Russell-st. will be macadamized for a distance of six blocks.

Superior, Wis.—Paving is proposed for Winter-st. from John to Oakes-ave.

Pittsfield, Mass.—Fenn and Melville-sts. and Columbus-ave. are to be paved.

Kalispel, Mont.—Plans are being prepared for paving Fourth-ave., east, with macadam.

Grand Forks, N. D.—Cedar block paving is contemplated for the alley in block 22.

Rutland, Vt.—An appropriation of $1,800 has been made for macadamizing three streets.

Rochester, N. Y.—The improvement of Commercial, Brown and other streets is contemplated.

Marinette, Wis.—About six miles of macadam paving will be laid on Webster-st. next year.

Streator, Ill. — Ordinances have been adopted for paving N. Park and Monroe-sts. with brick.

Norfolk, Va.—The sum of $45,000 has been appropriated for making improvements in the Seventh ward.

Rock Island, Ill.—Brick paving on Twenty-ninth-st. and asphalt on Twenty-first-st. and Fifth-ave. is contemplated.

New Orleans, La.—Specifications for asphalt paving on S. Rampart, Arabella, Nashville, Calliope and Dorgenois-sts. were submitted to council Sept. 22 by Chief Engineer Hardee.

Menominee, Mich.—The Bay Shore road will be macadamized for a distance of thirty-five miles. Rd. comrs.

Racine, Wis.—The estimated cost of paving Douglas-ave. with brick is $30,000 and Villa-st. $37,751.

Elyria, O.—A delegation of city officials visited Toledo Sept. 19 to examine the asphalt block pavements in that city.

Chicago, Ill.—Decisive action on the proposed asphalt paving on State-st. from Thirty-ninth to Sixty-third-st. has been postponed until 1904.

Sedalia, Mo.—A resolution was adopted Sept. 21 for grading and paving an alley between Fifth and Sixth and Ohio and Osage-sts.

Los Angeles, Cal.—The bd. of pub. wks. will recommend decomposed granite surfacing on two layers of crushed rock soaked in oil for seventeen streets.

Port Huron, Mich.—A resolution was adopted Sept. 22 to ask for bids for paving Tenth-st. with brick, bitulithic or tar macadam. Mayor Graves.

Peoria, Ill.—Resolutions were passed Sept. 21 for paving Western-ave. from Washington to Adams and from Adams-st. to Oakland-ave. with brick.

Watertown, N. Y.—A resolution has been adopted providing for the issue of bonds for paving State-st. with Warren Bros.' bitulithic macadam paving.

Evanston, Ill.—Brick and macadam paving are favorably considered for a large number of streets. Cy. clk. Hahn.

New Orleans, La.—Petitions for paving Octavia-st., between St. Charles-ave. and Pitt-st., with asphalt have been filed.

Mankato, Minn.—The street committee has recommended that cement curb and gutter be laid on Jackson and Hickory-sts.

Los Angeles, Cal.—The original petition for paving Hill-st. from First to Pico-sts. has been taken up for consideration.

Pasadena, Cal.—Asphalt paving, grading and guttering is contemplated for S. Fair Oaks-ave., between Dayton and Glendale-sts.

Brockton, Mass.—A petition is being circulated at Monument Beach for a state highway. W. H. Marble, Brockton, is interested.

Shirley City, Ind.—The town board has ordered all the principal streets macadamized, cement walks and sewers constructed.

Little Rock, Ark.—Asphalt paving on Scott-st., on the old vitrified brick surface, is contemplated. James F. Kieser, cy. engr.

East Orange, N. J.—The mayor has been authorized to macadamize, curb and flag Hollywood-ave., from Main-st. to the railroad. Cy. engr. Reimer

Crookston, Minn.—A resolution has been passed condemning all the wooden walks in the paved district and requiring the building of concrete walks.

Prairie du Chien, Wis.—An ordinance was passed Sept. 16 requiring the construction of cement walks on Michigan-st. between Bluff and Hayden.

Louisville, Ky.—The advisability of asking the general council for a special appropriation of about $65,000 for resurfacing Third-ave. its entire length is being considered.

San Francisco, Cal.—Specifications are being prepared for paving S. Broderick-st. with bituminous rock, Hickory-ave. with basalt block and granite curbs, and Twenty-first-st. with basalt blocks and stone curbs.

St. Joseph, Mo.—Ordinances were passed Sept. 14 for reconstructing the macadam paving on Second-st. from Antoine to Rosine, paving Patee-st. from Sixth to Tenth with brick and macadamizing and remacadamizing a number of streets.

Jefferson, Mo.—(Special.)—J. C. Herring, cy. engr., says that at a meeting held Sept. 21 the property owners representing about 21,000 square yards of streets to be paved voted in favor of asphalt. This represents seven blocks for which bids for Warren Bros. bitulithic pavement were advertised, but the contract not let.

CONTRACTS TO BE LET.

Washington, D. C.—Bids are asked until 7 p. m. Oct. 10 for building sidewalks. City coun.

Petersburg, Ind.—Bids are asked until Oct. 5 for improving certain streets. Co. comrs.

Green Bay, Wis.—Bids are asked until 12 m Oct. 9 for 2,191 cu yds. of excavations on Fisk-st. Cy clk.

Cleveland, O.—Bids are asked until Oct. 10 for macadamizing Depot road. Julius C. Dorn, clk. bd. co. comrs.

Decatur, Ind.—Bids are asked until 10 a. m. Oct. 10 for constructing the North Preble road in Preble twp. Bd. co. comrs.

Brownstown, Ind.—Bids are asked until 1 p. m. Oct. 6 for constructing 15 mls. and 1,688 ft. of gravel roads. Co. comrs.

Washington, D. C.—Sealed bids are asked until 12 m. Oct. 3 for laying cement walks. H. B. F. MacFarland, chmn. Dist. comrs.

Delphi, Ind.—Sealed bids are asked until 7 p. m. Oct. 6 for constructing 9 cement street crossings. John W. Fawcett, cy. clk.

San Antonio, Tex.—Sealed bids are asked until 12 m. Oct. 10 for constructing gravel roads in Bexar co. Robt. B. Green, co. judge.

Crawfordsville, Ind.—Sealed bids are asked until 4 p. m. Oct. 5 for grading and graveling Chestnut and John-sts. H. B. Hulett, cy. clk.

Fort Meade, S. D.—Bids are asked until 2 p. m. Oct. 17 for building macadam roads and cement walks at the fort. Capt. C. B. Vodges.

Ft. Dodge, Ia.—Bids are asked until Oct. 12 for paving Sixth and Seventh-sts. and Second, Third and Fourth-aves. with asphalt. D. A. Weller, cy. clk.

Evansville, Ind.—Bids are asked until 10 a. m. Oct. 3 for widening and grading Little Cynthiana road and St. Joseph-ave. Harry Stinson, co. audt.

Bluffton, Ind.—Sealed bids are asked until 10 a. m. Dec. 8 for constructing 15

gravel roads in Jackson twp. David Ochsenrider, chmn. co. comrs.

Lisbon, O.—Bids are asked until Oct. 20 for improving Nelson-ave. Lodge Riddle, vil. clk.

Lakewood, O.—Bids are asked until Oct. 12 for macadamizing Lake-ave. Henry J. Sensel, vil. clk.

St. Paul, Minn.—Bids are asked until 10 a. m. Oct. 5 for improving county roads. E. G. Krahmer, co. audt.

Sedalia, Mo.—Bids are asked until Oct. 5 for building brick sidewalks on numerous streets. C. E. Baker, cy. clk.

Green Bay, Wis.—Bids are asked until Oct. 9 for 2,004 cu. ft. of earth excavation on Gray-st. Com. on streets and bridges.

Sloan, Ia.—Bids are asked until 6 p. m. Oct. 5 for constructing a number of concrete walks. S. J. Oliver, town clerk.

White Plains, N. Y.—Bids are asked until Oct. 3 for grading, macadamizing and improving 6 mis. of highway. Jos. J. Shaw, town clk.

Buffalo, N. Y.—Bids are asked until Oct. 6 for paving St. Stephens-st. and repaving Perry and Erie-sts. Francis G. Wand, comr. pub. wks.

Muncie, Ind.—Bids are asked until Oct. 5 for grading, macadamizing and constructing 5 ft. cement walks on Jefferson-st. R. G. Hickok, cy. clk.

Cincinnati, O.—Bids are asked until Oct. 17 for paving with crushed stone a portion of Columbia-ave. in Columbia twp. E. L. Lewis, co. audt.

Jeffersonville, Ind.—Bids are asked until Oct. 5 for constructing 39 mis. of macadam and gravel roads in Charleston twp. Peter Dillon, chmn. bd. co. comrs.

Brooklyn, N. Y.—Bids are asked until Oct. 7 for 22,374 sq. yds. of asphalt and granite paving, 15,295 ft. curb and furnishing 3,851 cu. yds. concrete. J. E. Swanstrom, prest. boro.

New Albany, Ind.—Sealed bids are asked until 2 p. m. Oct. 19 for paving an alley between Thirteenth and Fourteenth and Market and Spring-sts., with vitrified brick. E. L. Brisby, cy. clk.

Indianapolis, Ind.—Sealed bids are asked until Oct. 12 for constructing cement sidewalks on Rural-st., from Tenth-st. to Massachusetts-ave., and Wisconsin-st., from Senate to Capitol-ave. Harold C. Megrew, chmn. B. P. W.

Benton Harbor, Mich—Sealed bids are asked until 8 p. m. Oct. 5 for 6,300 sq. yds. of asphalt paving on concrete base and 5,000 lin. ft. combination curb and gutter on three streets. Willard J. Banyon, cy. clk.

Kewanee, Ill.—Sealed bids are asked until 2 p. m. Oct. 3 for 15,000 sq. yds. of asphalt paving, 4,000 cu. yds. excavation and 7,200 lin. ft. concrete curb and gutter. E. C. O'Connor, prest. bd. local impvts.

Williamsport, Ind.—Sealed bids are asked until 7 p. m. Oct. 2 for constructing concrete sidewalks on Front-st., from Monroe to Depot, and for paving Monroe-st., from Third-st. to the west end of the bridge across Falls Branch. D. H. Moffitt, town clk.

Dayton, O.—Sealed bids are asked until 12 m. Oct. 20 for paving Linden-ave. with brick, asphalt or bituminous macadam as follows: Paving, 16,250 sq. yds.; straight curbing, 7,150 lin. ft.; circular curbing, 205 lin. ft.; stone headers, 950 lin. ft. Louis Haas, prest. B. P. S.

Cincinnati, O.—Bids are asked until Oct. 20 for asphalt, brick and granite block paving on six streets; grading, resetting curbs, repaving gutters and macadamizing Clifton-ave. Bids are asked until Oct. 15 for paving Race-st. with asphalt. George F. Holmes, clk. B. P. S.

Williamsport, Ind.—Bids are asked until Oct. 2 for grading, curbing, paving and constructing concrete sidewalks on Front-st. D. H. Moffitt, town clk.

Lakewood, O.—Sealed bids are asked until 12 m. Oct. 12 for macadamizing and improving Lake-ave. from Cook-ave. to Webb-road. Henry J. Seusel, vil. clk.

Lake Charles, La.—Sealed bids are asked until Oct. 6 for 19,500 sq. yds. of brick or asphalt paving. C. H. Winterhaler, mayor; C. M. Boren, city engr.

Providence, R. I.—Sealed bids are asked until 12 m. Oct. 7 for constructing 2,640 ft. of state highway in Jamestown. John H. Edwards, chm. state bd. pub. rds.

Greenville, Miss.—Sealed bids are asked until Oct. 6 for 30,000 sq. yds. of brick paving on concrete and 10,000 lin. ft. of stone curbing. Wm. Yerger, city clk.

Jefferson City, Mo.—Sealed bids are asked until 8 p. m. Oct. 12 for constructing 6,154 sq. yds. of vitrified paving on 6-in. concrete base. J. C. Herring, city engr.

Des Moines, Ia.—Sealed bids are asked until 11 a. m. Oct. 7 for paving State-st. from Arlington-ave. to Bluff-st. with vitrified brick on concrete. B. O. Hanger, chm. B. P. W.

Connersville, Ind.—Sealed bids are asked until 7:30 p. m. Oct. 5 for constructing 8 mis. of combined cement curb and gutter and 6½ mis. of rolled streets. Jacob S. Clouds, city clk.

Indianapolis, Ind.—Sealed bids are asked until Oct. 5 for constructing cement sidewalks in a number of streets and for grading and graveling an alley. Bids are asked until Oct. 7 for paving an alley with brick, grading and graveling certain streets and constructing cement sidewalks. Harold C. Megrew, chm. B. P. W.

CONTRACTS AWARDED.

Glens Falls, N. Y.—The Barber Asphalt Paving Company has been awarded a contract for street paving.

Buffalo, N. Y.—The contract for paving Rohr-st. with brick was awarded to L. H. Gipp for $5,937.

Pittsfield, Mass.—The contract for 7,500 ft. of paving and gutters was awarded to O. T. Benedict for $7,500.

Upper Sandusky, O.—The contract for building 3 miles of pike was awarded to Wm. Losey of Marseilles for $11,995.

Rome, N. Y.—The Barber Asphalt Paving Company was awarded the contract, Sept. 8, for paving Turn-st., for $6,979.73.

McKeesport, Pa.—The contract for paving Cronemeyer and Columbia-aves. was awarded, Sept. 8, to W. W. Kelley.

Chicago, Ill.—The Barber Asphalt Paving Company was awarded the contract for paving W. Madison-st., for $42,114.

Carroll, Ia.—The contract for paving two sides of the court house square was awarded to D. Schenck at $2.27 a sq. yd.

Rochester, N. Y.—The contract for paving Cameron-st., was awarded, Sept. 16, to the Rock Asphalt Paving Company for $12,610.

Sandusky, O.—The contract for building 9 miles of pike in Mifflin twp. was awarded to W. T. Kneuzil & Co. for $35,876.

Belvidere, Ill.—The contract for paving State-st. has been awarded to the Federal Asphalt Company of Chicago for $37,500.

Delphi, Ind.—The contract for 19 miles of good roads in Madison twp. was awarded to Capt. F. S. Eaton of Lafayette for $28,800.

Elizabeth, N. J.—The contract for 6,348 sq. yds. of trap rock block paving was awarded to W. H. Weldin of Rahway for $39,157.

Lincoln, Ill.—The contract for paving Stringer-ave. with brick was awarded, Sept. 13, to J. F. Bretz & Son of Springfield for $8,950.

Paxton, Ill.—The contract for paving Center and Washington-sts with brick was awarded, Sept. 12, to Thompson & Case of Peoria.

Ft. Scott, Kas.—The contract for building 6 mis. of macadam road was awarded, Sept. 11, to Grant Hornaday of Ft. Scott for $20,000.

Wichita, Kas.—The contract for paving Seneca and University-aves. and First-st. was awarded to the Barber Asphalt Paving Company Sept. 12.

Schenectady, N. Y.—The contract for grading, paving and curbing Romeyn-st. was awarded to the Schenectady Contracting Company for $7,478.

Champaign, Ill.—John W. Stipes secured the contract for paving N. Race-st. for $24,258.

Ashland, Ky.—The contract for granite paving on Center-st. was awarded to T. S. Mulligan of Lima, O.

Troy, N. Y.—The contract for granite paving on Ferry-st. was awarded to Behan & Cavanaugh for $22,000.

Paris, Ill.—Morrissey & Porter, city, was awarded the contract for brick paving Sept. 1 for $4,803.

Lexington, Mo.—The contract for forty-five blocks of brick paving was awarded to Sherwood Drake for $50,000.

Tiverton, R. I.—The contract for building one mile of stone road was awarded to H. C. Osborne for $5,280.

Freeport, Ill.—The Federal Asphalt Paving Company was awarded the contract for paving State-st. for $37,414.

Rochester, N. Y.—The Rock Asphalt Paving Company was awarded the contract for paving Cameron-st. with asphalt for $12,610.

Highland Park, Ill.—The contract for macadamizing the streets was awarded to James Cape & Sons of Racine, Wis., for $33,299.

Wellston, O.—The contract for paving Railroad-ave. with Sciotoville brick was awarded to Beeson Bros. of Middleport for $5,706.

Elkton, Md.—E. Ward Brown of Port Deposit was awarded a contract for building a macadam road from Rising Sun to Farmington, two miles, for $8,000.

Westchester, Pa.—The contract for constructing 5,000 feet of new road around the intrenchments at Valley Forge was awarded to William H. Doyle of Berwin.

Frederick, Md.—The contract for paving S. Market-st. was awarded Sept. 19 to J. U. Fritchey & Son of Lancaster, Pa., at $2.10 a square yard for Porter block.

Albany, N. Y.—Paving contracts were awarded Sept. 22 to John Doyle as follows: Delaware-st. $7,769.90; Elizabeth-st., $5,151.45; triangle in Englewood-pl., $2,044.

West Bay City, Mich.—The contract for paving Linn-st. from Midland to S. Union with asphalt, was awarded Sept. 21 to the Cleveland Trinidad Paving Company, at $1.99 a square yard.

Byron, Ill.—The contract for constructing several blocks of cement sidewalks was awarded Sept. 21 to Alex Latz of this city and Mr. Peterson of Rockford at 11 cents a square foot.

Denver, Colo.—The Western Realty and Paving Company was awarded the contract for paving alleys with blocks for $9,488. The contract for brick paving was awarded to the Colorado Paving Company for $12,417.84.

Rochester, N. Y.—Ripton & Murphy secured contracts Sept. 21 as follows: Grading and cement walks in St. Jacob-st., $2,030; cement walks, Glasser-st., $292; grading and cement walks Bernard-st., $1,010; cement walks Congress-ave., $640.

Newport, R. I.—Contracts for constructing certain sections of highway were awarded Sept. 23 as follows: Middletown, 2,050 feet, J. Overton Peckham, $3,306.38; So. Kingston and Charleston, 5,280 ft., John Bristow, $5,088.30; Scituate and Foster, 5,280 ft., Amos D. Bridge, $5,304.75.

Buffalo, N. Y.—Contracts have been awarded as follows: Barber Asphalt Paving Company, Lafayette-ave., with asphalt, $4,931, and Richfield-ave., with brick, $11,491; F. V. E. Bardol, Kingston Pl., brick, $3,750; German Rock Asphalt & Cement Company, Ellicott-st., $3,087; Eastern Const. Company, Sixteenth-st., $4,850.

St. Joseph, Mo.—The contract for paving S. Sixth-st. between the viaduct and King Hill-ave. with brick was awarded Sept. 22 to the Phoenix Brick and Construction Company at $2.50 a sq. yd. Other contracts awarded at the same time were as follows: Fred Roth, re-macadamizing Ninth-st., from Frederick-ave. to Robidoux; St. Joseph-st. Construction Company, Ninth-st., from Rid-

enbaugh to Church-sts., with Kentucky rock asphalt.; Phoenix Brick and Construction Company, Mitchell-ave., brick; Farmer & Dunn, remacadamizing Michel and Main-sts.

Wilmington, N. C.—Bids for paving 7,425 sq. yds. of paving on Market-st. were received Sept. 14 as follows: Roger Moore of Wilmington to furnish and lay Mack vitrified fireclay block, at $2.37 per sq. yd., or Georgia vitrified shale block at $1.87 per sq. yd. Coal, Cement and Supply Company of Wilmington, per sq. yd., Mack vitrified block, $2.17½; Pennsylvania block, $2.15; Georgia vitrified $1.81½; granite, $2.31 or $2.28; asphalt block, $2.25 per sq. yd. Southern Paving and Construction Company, Chattanooga, Tenn., $1.84 per sq. yd. for standard vitrified brick.

Taylorville, Ill.—(Special.)—The contract for brick paving was awarded Sept. 7 to P. H. Hunt & Co. of Decatur, Ill., for about $100,000.

Troy, N. Y.—Contracts for paving were awarded to T. H. Dumary of Albany as follows: Fulton-st. $3,300, Broadway, $2,867, Union-place, $3,917.

Independence, Kan.—The contract for paving the business section of this city with brick was awarded to J. C. Likes of Des Moines for $75,000.

Chicago, Ill.—(Special.)—Contracts for paving three streets with rock asphalt have been awarded the Federal Asphalt Paving Co. of this city.

Scottsburg, Ind.—The contract for building a good road in Lexington twp. was awarded to Barney Lamaster, and for one in Findlay twp. to Chas. F. Deal.

New Orleans, La.—The Barber Asphalt Paving Company was awarded the contract for paving Lafayette-st., from St. Charles to Carondelet-st. with asphalt.

Freeport, Ill.—Wm. Ascher was awarded the contract for macadamizing and curbing Douglas-ave., Mechanic, Walnut, Cherry, Green, Grove and West-sts. for $17,018.

Elkton, Md.—The contract for building macadam road from Rising Sun to Farmington was awarded Sept. 16 to E. Ward Brown of Port Deposit for $8,000.

Milwaukee, Wis.—The Badger Construction Co. was awarded contracts Sept. 9 for paving Virginia, Florida and Grove-sts. and First-ave. with asphalt at $2.05 a sq. yd.

Oneida, N. Y.—The contract for paving the north end of Main-st. with brick was awarded Sept. 8 to A. W. Fitch for $1,531.95. Syracuse brick will be used.

Providence, R. I.—Contracts for constructing state highways have been awarded as follows: North Providence and Smithfield, Wm. A. Sweet, $4,950; Gloucester, Amos D. Bridge Co., $2,952; New Shoreham, John C. Champlain, $2,500; West Greenwich, B. D. Pierce, Jr. Co., $3,410.

Akron, O.—Paving contracts were awarded Sept. 5 as follows: Ira-ave., P. T. McCourt, $14,695; E. Market-st., J. M. Davidson, $30,917; Main-st., Jas. Wilds, $22,697. The contracts for paving Wheeler Lane alley at $2,933 and Charlotte-st. for $2,952 were awarded to Dan Omarr.

Milwaukee, Wis.—Henry Hase was awarded the contract for 225 sq. yds. of brick paving in front of the engine house on Walnut-st., near Twenty-fourth-st. at $2.47 a sq. yd. Contracts for supplying crushed stone for street repairs were awarded to W. A. Story at $1.20 and Louis Manegold at $1.17 a cu. yd.

Springfield, Ill.—The contract for paving Glenwood-ave., from Jefferson to Edward-st. with brick was awarded Sept. 15 to J. F. Bretz & Son at $1.34 a sq. yd. and 50 cts. a lin. ft. for curbing. The contract for building brick sidewalks in the Second ward was awarded to Richard Egan at 64½ cts. a sq. yd.

Dayton, O.—The contract for resurfacing Keowee and Third-sts. was awarded to the Kirchner Constructing Co. at $1.74 a sq. yd. for brick, and $1.70 for concrete foundation.

New York City—Bids were submitted Sept. 17 as follows:

For furnishing and laying cement sidewalks on Eastern Parkway, between Prospect Park Plaza and Ralph-ave., Brooklyn Boro.—Atlantic Constr. Co., $24,400; P. B. Elkins Co., $29,217.50; Arthur Nosworthy, $23,650; Wm. C. Owen, $29,225; Rockefeller & Hazzard, $26,982; Vulcanite Paving Co., $29,250; Jas. H. Whaley, $24,500.

Paving with asphalt on concrete found, roadway of Stone-ave. from E. Parkway extension to Riverdale-ave., Brooklyn Boro.—Brooklyn Alcatraz Asphalt Co., $57,645; Cranford Co., $55,615; Uvalde Asphalt Paving Co., $58,865.

Paving with rock asphalt mastic gutters of carriage drives in Central Park, Manhattan Boro.—Neuchatel Asphalt Co., Ltd., $14,625; The Sicilian Asphalt Paving Co., $12,900; Vulcanite Paving Co., $15,772.

Paving with asphalt block roadway of Bushwick-ave. from Jamaica-ave. to E. Parkway extension, Brooklyn Boro.—Continental Asphalt Paving Co., $33,600; the Hastings Pavement Co., $29,115.

Grand Rapids, Mich.—Paving contracts were awarded Sept. 11 as follows: N. Lafayette-st., bituminous macadam, A. C. Sekell, $6,249; alley in rear of city hall, brick, John H. Sullivan, $1,514.44; grading and graveling Umatilla-st., Kloote & Vanderveen, $680.

Seattle, Wash.—The Barber Asphalt Paving Company was awarded contracts Sept. 14 for asphalt paving on Queen Anne-ave., from Roy to Galer for $981 and on Queen Anne-ave. for $16,907.50.

West Bay City, Mich.—The Cleveland Trinidad Paving Company of Cleveland, O., was awarded the contract Sept. 21 for paving Linn-st., from Midland to S. Union, with asphalt at $1.99 a sq. yd.

Newark, N. J.—Paving contracts were awarded to J. Roosevelt Shanley Sept. 10 as follows: Prospect-place, brick, $2,194.65; Aqueduct alley, brick, $3,301; Van Buren-st., granite, $17,696.

St. Joseph, Mo.—Rackliffe & Gibson secured the contract Sept. 14 for paving Louis-st., between Third and Dewey-ave., at $1.19 a sq. yd. for Galesburg brick and 35 cts. a cu. yd. for grading.

Rochester, N. Y.—Paving contracts have been awarded as follows: South-ave., trap rock, H. B. Hooker & Son, $21,423; Platt-st., Medina block, Whitmore, Rauber & Vicinus, $5,079.

Bloomington, Ill.—The Barber Asphalt Paving Company was awarded contracts Sept. 3 for asphalt paving on Graham-st. for $16,000 and on Fell, Colton and Towanda-aves. and Monroe-st. for $15,555.

Boston, Mass.—Contracts have been awarded for constructing three sections of highways as follows: Worcester, Farranti & Maguire, $6,294; Westminster, R. F. Hudson, $8,982; Amesbury, Jas. E. Walkins, $5,091.

St. Paul, Minn.—Fielding & Shepley secured paving contracts Sept. 14 as follows: Paving Reid's court, from Shelby to Maiden lane, $524.85; curbing and improving St. Peter-st., from Aurora to Central terrace, $1,543.

Arlington, N. J.—The contract for paving Chestnut-st. was awarded Sept. 9 to Van Keuren & Son of Jersey City as follows: 1,850 sq. yds. Clearfield block, $2.40; 1,000 lin. ft. curb reset in concrete, 20 cts.; 100 lin. ft. new curb, 60 cts.; 100 lin. ft. new curb not set in concrete, 48 cts.; 7,200 sq. yds. 12-inch macadam, $1.18; 4,900 lin. ft. curb reset, 10 cts.; 4 brick catch basins, $125; 1,640 sq. yds. gutters relaid, 23 cts.; 900 sq. ft. bridge stone, 60 cts.; 15 manholes, $2.50; 1,400 sq. ft. new 4 ft. flag, 29 cts.; 50 lin. ft. sewer connections, 50 cts.; total, $16,404.

Atchison, Kas.—The contract for paving Commercial and Sixth-sts. with brick was awarded Sept. 7 to the Phoenix Brick and Construction Company of St. Joseph, Mo., as follows: Commercial-st. —2,604 ft. curb reset, 10 cts. a ft.; 1,878 ft. new cement curb, 50 cts. a ft.; 19,098 sq. yds. brick on old concrete, $1.27½ a sq. yd.; 50 cu. yds. hydraulic cement concrete, $5.00; 100 sq. yds. pavement relaid, 20 cts. a sq. yd.; 1,600 ft. cement sidewalk, 16 cts. a sq. ft.; 30 cu. yds. rubble masonry, $3; repairing 21 sewer inlets, $2; S. Sixth-st.—4 cu. yds. concrete, $7; 186 ft. 15 in. sewer, 64 cts.; catch basin, $10; 23 vert. ft. manhole, 68 cts.; 5 sewer fixtures, $8; relaying 6,377 sq. ft. brick sidewalk, 7½ cts.; 2,300 sq. yards, 1 course brick paving, $1.19½; 13,502 sq. yds. 2-course brick paving, $1.44 7-10; 10,596 ft. cement curb, 42 cts.; 400 cu. yds. rock exca., 84 cts.; 27,822 cu. yds. grading, 29½ cts.

SEWERS.

Chicago, Ill.—The supreme court held its first session Sept. 21 in the injunction suit of the state of Missouri vs. the state of Illinois and the Sanitary District of Chicago.

CONTEMPLATED WORK.

Winton Place, O.—Sewers are proposed.

Albia, Ia.—A sewer on Jackson-st. S. is contemplated.

Clinton, Ia.—A sewer is proposed in district No. 12.

Glastonbury, Conn.—A sewerage system is contemplated.

Haverhill, Mass.—The construction of sewers is contemplated.

Aberdeen, S. D.—The sewage disposal system will be improved.

Rockwell City, Ia.—A 6-in. sewer in blocks 1, 2 and 3 is proposed.

Devil's Lake, N. D.—Plans for a sewer in Seventh-st. will be prepared.

Merrill, Wis.—A sewer will be built in W. Main-st. next spring.

Portsmouth, O.—Plans are being prepared for a sewer in Robinson-ave.

Seneca Falls, N. Y.—The question of sewers will be voted on in March.

Bottineau, N. D.—The question of a sewerage system is being agitated.

Athens, Ala.—The question of issuing sewer bonds was favorably voted on.

Evanston, Ill.—Sewers will be constructed on a number of streets. Mayor Barker.

Lansing, Mich.—A sewer is proposed in Weinman Cut valley. H. A. Collar, city engr.

Topeka, Kas.—The construction of a sewerage system is favored by City Engr. McCabe.

Corning, Ia.—Final action on the proposed sewer on Davis-ave. will be taken Oct. 1.

Chisholm, Minn.—Plans for a sewerage system will be made by O. Claussen of St. Paul.

London, O.—Plans for a sewerage system have been prepared by John P. Force of Columbus.

New Bedford, Mass.—A petition has been submitted asking for 1,300 ft. of sewer in Lucas-st.

Beverly, Mass.—A petition has been submitted asking for sewers in Knowlton and Prospect-sts.

Rockaway Beach, L. I., N. Y.—The sewerage system will be improved, according to press reports.

Worcester, Mass.—The construction of sewers in four streets at a cost of $5,000 is contemplated.

Monroe, Wis.—The municipal committee will recommend a septic tank sewage disposal system.

Ottawa, Ill.—The estimated cost of the proposed East Side sewer system is about $35,000.

Cuyahoga Falls, O.—The village council has approved plans for a sewerage system to cost $185,000.

Saginaw, Mich.—A resolution has been adopted to build a sewer in State-st. from Meishon to Bay-st.

St. Paul, Minn.—The property owners of St Albany Park are in favor of the proposed sewerage system.

Marietta, O.—A report has been submitted of the cost of building sewers on Mathews, Harman and Lord-sts.

St. Joseph, Mo.—Brookdale in the extreme eastern part of this city, desires the construction of a sewer.

Leominster, Mass.—Plans for a new sewage disposal system will probably be made by J. Van Valkenburg of South Framingham.

Royal Center, Ind.—A petition is being circulated asking for the construction of a 24 or 30 inch main sewer.

Lowell, Mass.—An ordinance was passed Sept. 8 providing for a loan of $25,000 for building new sewers in Pawtueketville.

Jersey City, N. J.—The question of building an outlet sewer in the southern section of N. Bergen-st. is being discussed.

Pawtucket, R. I.—The town council appointed a committee Sept. 18 to investigate the feasibility of constructing a sewerage system.

Eastville, Ill.—The Iowa Engineering Company of Clinton, Ia., has completed and submitted plans for a sewerage system for this city.

Cincinnati, O.—An ordinance was passed Sept. 14 appropriating $5,000 for making preliminary surveys for the sewer from Glendale to the Ohio river.

Ft. Dodge, Ia.—Resolutions have been passed for building a fifteen inch sewer on Thirteenth-st. with six catch basins and an eight inch sewer on Forrest-ave.

Denison, Ia.—A sewerage system is proposed.

Bay Ridge, N. Y.—Sewers will be constructed.

Missoula, Mont.—A sewer on W Front-st. is contemplated.

Hanover, Mass.—The question of drainage is being considered.

Woonsocket, R. I.—A sewer in Bentley-st. has been recommended.

Fairview, Mich.—Plans have been authorized for a sewerage system.

Santa Rosa, Cal.—Plans for 3,400 ft. of main pipe sewer have been prepared.

Hoquiam, Wash.—A resolution has been passed to build a sewerage system in Harr's addition.

Sherman, Tex.—Sewer extensions are contemplated for Travis, Walnut, Pecan and Crockett-sts. Cy. Engr. Hayden.

Kansas City, Mo.—A septic tank sewerage system is contemplated for the southeastern part of this city. J. H. Arnold, interested

Marlboro, Mass.—The plans for the proposed auxiliary sewer system provide for 12,000 ft. of 4-in. tile pipe with open joints. Jas. F. Bigelow, cy. engr.

East St. Louis, Ill.—Plans for the proposed sewerage system for the entire length of the city and to empty into the Mississippi river 2 mls. south of the city limits were submitted Sept. 12 by Cy. Engr. Helms.

Niles, Mich.—Resolutions have been passed to build a main trunk sewer on Grant-st. and to relay and lower the 15-inch tile sewer in Ferry-st.

Wyandotte, Mich.—Riggs & Sherman, Toledo, O., have filed a report with the bd. of pub. wks. on the proposed sewerage system; estimated cost $132,920.

Penn Yan, N. Y.—Willis B. Goodwin, C. E., Bangor, Me., has been appointed assistant engineer in the proposed construction of a sewerage system in this city.

Salem, Mass.—A trunk sewer with an outlet at "Great Heaster" in Salem bay, and including a pumping station near Winter island, will be built at a cost of $450,000.

Fitchburg, Mass.—The special committee on sewage disposal has recommended purification by sand filtration. Plans and specifications will be submitted on or before Dec. 8.

Portage, Wis.—A. J. Klenert, William Edwards, M. J. Downey, Charles Lauterbach and Richard Thiel have been appointed a committee to consider the advisability of establishing a municipal sewerage system.

Chicago, Ill.—The property owners on the southwest side have asked for the construction of a sewerage system. The plan involves the construction of a 12-foot sewer in Western-ave., at a cost of about $150,000.

Hyattsville, Md.—Charles N. Darnall, Howard Moran, R. E. White, D. V. Mitchell, Dr. Joseph A. Mudd and William P. Magruder have been appointed a committee to consider the feasibility of installing a sewerage system. Charles A. Wells, mayor.

Auburn, N. Y.—(Special.)—George S. Pierson, Mem. Am. Soc. C. E., Kalamazoo, Mich., has been retained to prepare plans for revising and extending the sewer system and for sewage purification plants. The state board of health recommends the separation of the sewage proper from the storm water, and the purification of the sewage. This will necessitate a rearrangement of the sewer system already built, which consists of about sixty miles of sewers, most of which are combined sewers. Intercepting sewers will also be required and probably three sewage purification plants.

CONTRACTS TO BE LET.

Valley City, N. D.—Bids are asked until Oct. 5 for building sewers. Cy. audt.

Anoka, Minn.—Bids are asked until Oct. 5 for building sewers. Nicholas Moberg, cy. clk.

Smith's Falls, Ont.—Bids are asked until Oct. 4 for building pipe sewers. Harry Walch, town engr.

Nappanee, Ind.—Bids are asked until Oct. 9 for building a sewer in Main-st. Q. J. Reinoehl, town clerk.

Crookston, Minn.—Bids are asked until Oct. 10 for constructing a drainage ditch 18 mls. long at Fosston.

Albert Lea, Minn.—Bids are asked until 7:30 p. m. Oct. 9 for 1,850 ft. brick sewer. C. E. Brainerd, cy. clk.

Center City, Minn.—Bids are asked until 10 a. m. Oct. 6 for constructing ditch No. 2. A. B. Slattengren, co. audt.

Chicago, Ill.—Sealed bids are asked until Nov. 4 for excavating a channel as

an extension of the North Branch of the Chicago river northward to Lawrence-ave. Thos. A. Smyth, prest. bd. trustees.

Lancaster, Pa.—Sealed bids are asked until 12 m. Oct. 15 for building 15,000 ft. of brick sewer. J. H. Rathfon, cy. cont.

Monticello, Ind.—Bids are asked until 12 m. Oct. 3 for constructing Ella Baker ditch in Big Creek and Prairie twps. Co. audt.

West Orange, N. J.—Sealed bids are asked until 8:30 p. m. Oct. 6 for constructing sections 1, 2 and 3 of the sewerage system. Simeon H. Rollinson, chmn. town comr. J. McDonough, town clk.

Winton Place, O.—Bids are asked until Oct. 15 for building sewers. Louis G. Bittoe, vil. clk.

Burlington, Ia.—Bids are asked until Oct. 4 for building a portion of Bonn's hollow sewer. City clk.

McKees Rocks, Pa.—Bids are asked until Oct. 5 for building a 5-in. pipe sewer in Snyer-ave. S. L. Gardner, boro. engr.

Merrill, Wis.—Bids are asked until Oct. 13 for building a sewer with manholes, catch-basins, etc. B. J. Lambert, city clk.

Mason City, Ia.—Sealed bids are asked until 8 p. m. Oct. 5 for building a lateral sewer with manholes. J. H. M. Ewen, city clerk.

White Plains, N. Y.—Bids are asked until Oct. 5 for building a lateral sewer through Rathbun-ave. Peter Paulding, vil. clk.

Valley City, N. D.—Bids are asked until 8 p. m. Oct. 5 for building sewers on Fourth-st., Fourth and Seventh-aves. W. T. Craswell, city audt.

South Bend, Ind.—Bids are asked until Oct. 14 for building a trunk sewer of brick or concrete and pipe sewers. A. J. Hammond, city engr.

Lakewood, O.—Bids are asked until Oct. 12 for laying sewer mains in St. Charles-st., Cook-ave. and Warren-road. Henry J. Sensel, vil. clk.

New York City—Bids are asked until Oct. 2 for 23,560 ft. of 6-in. to 5½-ft. brick and pipe sewer and 195 manholes. Prest. Bronx boro.

Cape Charles, Va.—Sealed bids are asked until 8 p. m. Oct. 15 for 9,155 ft. of 10, 8 and 6-in. terra cotta sewers. I. J. Burbage, city clk.

Rushville, Ind.—New bids for constructing a sewerage system will be received Oct. 15. The bids received Sept. 22 were rejected as too high.

Cincinnati, O.—Bids are asked until Oct. 6 for an intercepting sewer along West Fork creek south of Colerain-ave. Geo. F. Holmes, clk. B. P. W.

Cleveland, O.—Sealed bids are asked until 12 m. Oct. 8 for a sewer in Woodland Hills-ave. from Kinsman-st. to Kingsbury run. W. J. Springhorn, prest. B. P. S.

Kewanee, Ill.—Sealed bids are asked until 2 p. m. Oct. 3 for 2,180 ft. of 12, 10 and 9-in. storm sewers on S. Main-st. with 18 inlets and 10 manholes. John E. Kemp, city engr.

CONTRACTS AWARDED.

Brainerd, Minn.—The contract for a sewerage system was awarded to Judd Wright for $12,000.

Sharon, Pa.—The contract for constructing sewers was awarded to Wm. McIntyre & Sons for $22,000.

Palmer, Mass.—The contract for a sewer in St. Main-st. was awarded to Seymour & Newell of Springfield.

Sauk Center, Minn.—Frazer & Elliott awarded the contract for building sewers for $10,197.

Atlanta, Ga.—The contract for constructing trunk sewers was awarded to the Atlanta Construction Co. for $100,000.

LeSueur, Minn.—The contract for building a sewer was awarded to Wm. C. Fraser and Robert Elliott.

Redlands, Cal.—H. M. Zauft secured the contract for a sewer in Park-ave. Sept. 16 for $687.

St. Joseph, Mo.—Sewer contracts were awarded Sept. 13 to Rackliffe & Gibson, G. O. Skilbred and John Munell.

Rome, N. Y.—Frank George was awarded a contract for a storm sewer on Jay and Thomas-sts. for $3,874.50.

Newark, N. J.—The contract for building the Peddie-st. sewer was awarded Sept. 10. to J. Roosevelt Shanley for $135,375.

Seattle, Wash.—The Coast Concrete Co. was awarded contracts Sept. 12 as follows: Sewer, Twenty-sixth-ave., S., $3,195; Twenty-ninth-ave., S., $4,050.50.

Moscow, Idaho—The contract for constructing 9,138 ft. of sewers was awarded to Jos. C. Broad of Spokane, Wash., for $11,765.

Oelwein, Ia.—The contract for building sewers in Grand View-st. and Second-ave. E. was awarded to R. C. De La Hunt of Cedar Rapids for $8,239.

Elizabeth, Pa.—The D. V. Ault Co. of McKeesport was awarded the contract for a sewerage system in the North End for $9,290.

Granite City, Ill.—The contract for constructing sewers for the Glucose Co. has been awarded to David Ryan of Alton, Ill., for $2,300.

Providence, R. I.—F. E. Shaw was awarded the contract for building a main trunk sewer on N. Main-st., from Slenton-ave. to Third-st.

San Jose, Cal.—Joseph Ward secured the contract for a sewer in Seventh-st., for $1,990.

Geneva, O.—C. O. Simmons was awarded the contract for a lateral sewer system for $22,934.

Sharon, Pa.—The contract for building sewers was awarded to Wm. McIntyre & Sons for $22,000.

Springfield, Mass.—F. T. Ley & Co., city, secured the contract for a sewer in Riverdale-st. for $4,015.

Erie, Pa.—Dennis O'Brien secured the contract Sept. 17 for constructing sewers in Browns-ave. and Plum-st.

Ft. Brown, Tex.—The contract for a sewerage system was awarded to F. J. Sargent of Jennings, La., for $8,063.

Owensboro, Ky.—Henry Egenman of Rockport was awarded the contract for building the west end sewer for $2,975.

Palmer, Mass.—The contract for building a sewer in S. Main-st. was awarded to Seymour & Newell of Springfield.

Wichita, Kas.—The contract for building a sewer in district No. 4 was awarded Sept. 15 to Wm. C. Dorsey of Terre Haute for $6,897.

Naugatuck, Conn.—The contract for building sewers on several streets was awarded Sept. 15 to Jas. Sutton of Waterbury for $7,474.

Saginaw, Mich.—Eddy & Mikolaizky secured the contract for building sewers in Ward, Fayette, Bond, Ninth, Eleventh, Tenth, Farwell and Second-sts.

Nashville, Tenn.—The contract for building a sewer in an alley between Marks and Foster-sts. was awarded to W. J. Broderick for $1,209.

Hartford, Conn.—The contract for sewers in Maple-ave., Mountford and Broad-sts. was awarded to the Hartford Paving and Cement Company for $4,671.

Mankato, Minn.—John McCall was awarded the contract for a sewer on N. Second-st., from Spring to Vine for $2,510 and $9 each for house connections.

Woodstock, Ont.—The contract for constructing septic tanks for the new sewage disposal system has been awarded to Walter Mills of Ingersoll.

Milwaukee, Wis.—The contract for extending the South Milwaukee tunnel 1,500 ft. further into the lake was awarded to W. H. Wheeler & Co. of Chicago.

Washington, D. C.—The contract for section B of the B.-st. and Jersey-ave. sewer was awarded to Cavan, Guiney & Jones, and for section C to Andrew Gleason.

Phillipsburg, Pa.—The contract for building brick sewers was awarded to Geo. H. Hardner of Allentown for $17,870, and for pipe sewers to B. D. Myers of Wilkesbarre for $8,971.89.

Springfield, Ill.—The contract for building two 18-in. sewers was awarded as follows: Fourth-st., 83 cts. a lin. ft.; 12-in. inlet pipe, 40 cts.; manholes, $25 each; lampholes, $2.50 each; Second-st., 83½ cts.; 12-in. inlet pipe, 40c; manholes, $25 each.

WATER-WORKS.

Lititz, Pa.—The question of purchasing the plant of the Lititz Water Company will be voted on in November.

Flint, Mich.—Oct. 15 will probably be the date on which the proposition to purchase the water works plant will be voted on.

CONTEMPLATED WORK.

Portland, Me.—Municipal water works are proposed.

East Arlington, Vt.—Surveys for a water works system are being made.

North Tarrytown, N. Y.—The village trustees are considering the question of a water supply.

Cassville, Wis.—The extension of the water mains is contemplated. F. J. Dietrich, vil. clk.

Bridgeport, Conn.—The Bridgeport Hydraulic Co. contemplate installing a new filtration system.

Hilton, N. Y.—The construction of a water works system is contemplated. Hanford Bass and Dr. Williams interested.

Gloucester, N. J.—Plans and specifications for a water works system have completed. John H. Boylen, mayor.

Owensboro, Ky.—Plans and specifications for a water works system have been made by J. P. Force, of Columbus, O.

Lawrence, Mich.—A combination water works and electric light plant is discussed, according to press reports.

Garvanza, Cal.—The extension of the water works system to Oak Hill and Highland Park additions is contemplated.

Cazenovia, N. Y.—The tax payers voted Sept. 17 an appropriation of $7,000 for extending the water works system.

Kansas City, Mo.—This city voted Sept. 22 to issue $2,175,000 of bonds for the improvement of water works, market house, etc.

Evanston, Ill.—The construction of water mains in Lincoln, Lyons, Church, Tinn and Emerson-sts. is contemplated. Mayor Barker.

The question of issuing bonds for constructing water works systems will be voted on as follows: Dyer, Tenn.; Beardstown, Ky.; Miamisburg, O.

Jackson, N. H.—Surveys and estimates for water works for this town will be made by A. W. Dudley, of Manchester, N. H. Address Charles W. Gray, Jackson.

Ashfield, Mass.—Plans for a water works system have been completed by E. C. Davis of Northampton and bids will be asked at once for the work of construction.

Burlington, Kan.—(Special.)—B. H. Colby of St. Louis has been engaged to draw plans for a concrete dam across Neosho river for the Excelsior Water Mill Co.

McMinnville, Ore.—W. B. Chase, C. E., estimates the cost of installing a water plant and reservoir and head works seven miles from this city at $46,864.

Sandusky, O.—A filtration plant is contemplated.

Downing, Wis.—A water works system is proposed.

Rockford, Ill.—An additional water supply is proposed.

Peabody, Mass.—The improvement of the water system is recommended.

Hillsboro, Tex.—Steps are being taken to secure a better water supply.

Mora, Minn.—A water works system is proposed at a cost of $12,000.

Lake Crystal, Minn.—Plans are being prepared for a water and lighting system.

Spencerport, N. Y.—Dr. Holman, Hanford Bass and John Tompkins have been

appointed a committee to investigate the cost of water works.

Bardstown, Ky.—The construction of water works will be voted on in November.

Warren, Mass.—The town voted to appropriate $3,000 for extending the hydrant system.

Waterville, N. Y.—Surveys are being made for the enlargement of the water works system.

Seattle, Wash.—Plans for a water works system for Green Lake have been completed by Cy. Engr. Thompson.

Burlington, Ia.—Council has authorized the construction of over four miles of new water mains. Mayor Marquardt.

Carlisle, Ky.—Henry Stubing of Louisville has completed a preliminary survey for a water works plant for that place.

Winona, Minn.—The water works committee of the council recommends the purchase of an engine and the construction of a reservoir.

Cienfuegos, Cuba—Plans have been submitted for a gravity water supply, with a distributing reservoir and a new distribution system.

Tampico, Ill.—A petition is being circulated asking the board of trustees to call a special election to vote on the question of installing a water works system.

Homestead, Pa.—The borough council voted Sept. 21 to erect a 4,000,000 gallon pump at a cost of $15,000 and to lay an eighteen-inch water main from the reservoir to the pump house, one mile, at a cost of $21,500.

East Hampton, Mass.—The water commissioners favor the extension of a 90,000,000 gallon reservoir on Basset Brook, the establishment of a pumping station, a sixty horse power water wheel and a one hundred horse power gasoline engine.

The construction of water works systems is contemplated by the following places. Ecorse, Mich.; London, Ky.; Daytona, Fla.; Bristol, Tenn.; Owenton, Ky.; Crestline, O.; Oronogo, Mo.; Ellisville, Miss.; Franklin, Tenn.

The question of issuing water works bonds has been favorably voted on at the following places: Barberton, O.; Ellisville, Miss.; White Castle, Ia.; Hawkinsville, Ga.; Genesee, Idaho; Winston-Salem, N. C.

Port Vue, Pa.—A number of business men of McKeesport have formed a company and will apply for a charter for right-of-way to lay water mains in the streets of this borough. The officers of the company are: President, R. T. Carothers; vice-president, D. H. Lynch; secretary and treasurer, E. W. Pitts.

Onarga, Ill.—Bids are asked until Oct. 8 for a water works system. Ira F. Palmer, prest. bd. trustees.

CONTRACTS TO BE LET.

Helena, Mont.—Bids are asked until Nov. 25 for building a municipal water system. City clk.

Ligonier, Ind.—Sealed bids are asked until Oct. 5 for a water works system. Fred H. Green, mayor.

Jamestown, N. D.—Bids are asked until 5 p. m. Oct. 5 for water main extensions. Chas. T. Hill, co. audt.

Lennox, S. D.—Bids are asked until Oct. 7 for building a water works system. H. C. Newendorf, vil. clk.

Onarga, Ill.—Sealed bids are asked until Oct. 8 for a water works system. Ira F. Palmer, prest. bd. trustees.

Valley City, N. D.—Bids are asked until 8 p. m. Oct. 5 for constructing water mains. W. T. Craswell, city audt.

Lake Mills, Wis.—Bids are asked until 8 p. m. Oct. 5 for the construction of a concrete water tower. N. H. Falk, vil. clk.

Seattle, Wash.—Bids are asked until Nov. 3 for 25,440 ft. of 8 to 12-in. water mains in Rainier-ave. R. H. Thompson, cy. engr.

Hochne, Colo.—Bids are asked until Oct. 19 for constructing an artesian well near this place. L. C. Carpenter, State Engr., Denver.

Lennon, S. D.—Bids are asked until 7 p. m. Oct. 7 for constructing a water works system. H. C. Newendorf, vil. clk.

Tiffin, O.—Bids are asked until Oct. 19 for a 20-yr. water works franchise. John E. Diemer, cy. clk.; Mark L. Leister, mayor.

Denver, Colo.—Sealed bids are asked until Oct. 19 for driving and casing an artesian well near Manassa. L. G. Carpenter, state engr.

Chicago, Ill.—Sealed bids are asked until Oct. 2 for laying water mains in a number of streets. A. M. Lynch, prest. bd. local impvts.

Denver, Colo.—Sealed bids are asked until Oct. 19 for driving and casing an artesian well near Manassa. L. G. Carpenter, state engr.

Lakewood, O.—Bids are asked until Oct. 12 for laying water mains in St. Charles-st., Cook-ave. and Warren-road. Henry J. Sensel, vil. clk.

Joliet, Ill.—Sealed bids are asked until 7:30 p. m., Oct. 28, for supplying certain c. i. water pipe, valves, specials, etc. Matt Berscheid, cy. clk.

Red Lake Falls, Minn.—Bids are asked until 6 p. m., Nov. 15, for competitive plans and specifications for a water works system. A. P. Toupin, cy. clk.

Washington, D. C.—Bids are asked until Oct. 31 for constructing a water and sewerage system at New Orleans navy yard. M. T. Endicott, ch. bureau yds. & docks.

Walnut Grove, Minn.—Bids are asked until 8 p. m., Oct. 3 for 1,116 ft. 6-in. and 1,322 ft. 4-in. water mains and 6 hydrants. Bids will also be received for the work complete or for labor and materials separate. P. E. Storoegard, vil. rec.

CONTRACTS AWARDED.

Newark, N. J.—John Hinchliffe of Paterson was awarded the contract Sept. 17 for erecting two gate houses at Cedar Grove Reservoir for $16,800.

Flandreau, S. D.—W. D. Lovell of Des

Moines was awarded the contract for furnishing this city with a water tank and water tower for $3,980.

Washington, La.—The contract for completing the water works already under construction was awarded Sept. 14 to A. B. Sanders of Beaumont, Tex., for $13,635.

Schuylerville, N. Y.—The contract for constructing water works was awarded to C. J. Riordan for $22,000.

Washington, Ia.—The contract for completing the water works system has been awarded to J. W. Sanders of Beaumont, Tex.

Morris, Ill.—The Laidlaw-Dunn-Gordon Company of Cincinnati was awarded the contract for an air compressor pump for $2,710.

Whiting, Ind.—The contract for laying 5,246 feet of six inch c. i. pipe was awarded to John M. Healy of Chicago for $6,925.

Monument, Colo.—A franchise to maintain and operate a water works system for a term of fifty years has been granted to Thomas J. Chase.

Delavan, Ill.—The contract for constructing a steel water tower and tank has been awarded to the Chicago Bridge and Iron Company of Chicago for $4,790.

Gowanda, N. Y.—The Bacon Air Lift Company of New York City was awarded the contract for an additional water supply at Gowanda State hospital for $12,215.

Rochester, N. Y.—The contract for constructing the plant and laying the mains of the Rochester & Lake Ontario Water Company was awarded to the American Pipe Manufacturing Company of Philadelphia.

BRIDGES.

Armourdale, Kas.—Plans for the Fifth-st. bridge are being prepared.

Muncie, Ind.—The Delaware county council has made appropriations for new bridges.

Olivet, S. D.—Bids are asked until Oct. 6 for four steel bridges. D. D. Wipf, co. audt.

Princeton, Ill.—Bids are asked until 11 a. m. Oct. 8 for building iron bridges. Co. comrs.

South Bend, Ind.—Sealed bids are asked until 10 a. m. Oct. 6 for 2 iron bridges. John M. Brown, co. audt.

Marshalltown, Ia.—Plans for a street bridge over all the railroad tracks on Center-st. have been prepared.

Newark, O.—Bids are asked until Oct. 5 for masonry superstructure of Kingsely bridge. A. R. Pirser, co. audt.

Casey, Ill.—Parker twp. voted Sept. 13 to build a bridge across the north fork of Embarras river at Ulrey Ford.

Monticello, Ind.—Bids are asked until 12 m. Oct. 6 for constructing the superstructure of bridge No. 19, White Co., Bd. co. comrs.

Bushnell, Ill.—Petitions have been submitted for building 2 bridges across Crooked Creek, one in Emmet twp. and one in Tennessee twp.

Kansas City, Kas.—Sealed bids are asked until 12 m. Oct. 5 for a steel bridge across the Kansas river at Twelfth-st. Frank Holcomb, co. clk.

San Antonio, Tex.—Sealed bids are asked until 12 m. Oct. 10 for building necessary bridges in Bexar co. Robt. B. Green, co. judge.

Michigan City, Ind.—A new bridge with concrete abutments over Romel ditch, on Ohio-st., has been decided upon by Comrs. Kelling and Weaver.

Williamstown, Ky.—The question of appropriating $13,000 for building a bridge over Eagle Creek will be voted on Nov. 5. R. L. Kuman, co. clk.

Camden, N. J.—Bids are asked until Oct. 14 for reconstructing a fixed bridge over Cooper's Creek at Stony's Landing. John J. Albertson, co. engr.

Indianapolis, Ind.—Sealed bids are asked until 10 a. m. Oct. 5 for a concrete steel arch bridge over the canal in Washington-st. Harold C. Megrew, chmn. B. P. W.

Denver, Colo.—Sealed bids are asked until Oct. 10 for building a highway bridge across the Arkansas river, about 8 mis. east of Pueblo. L. G. Carpenter, state engineer.

Atlanta, Ga.—Bids are asked until Nov. 14 (extension of time) for building a bridge over Chattahoochie river between Fulton and Cobb counties and Pace's Ferry. E. P. Rosser, chmn. comrs. rds. and revenues.

Columbus, O.—Sealed bids are asked until 2 p. m. Oct. 5 for the substructure of the Chenowith mill bridge, strengthening superstructure, relaying old floor and laying new sidewalks on superstructure of St. Clair-ave. viaduct; constructing permanent roadway on east driveway of St. Clair-ave. viaduct. L. E. Jones, co. audt.

STREET LIGHTING.

Currie, Minn.—A gas plant is contemplated.

Geneva, Neb.—A municipal gas plant is proposed.

Williamsport, Pa.—A municipal plant is proposed.

Seaford, Del.—Bids will be asked soon for an electric light plant.

Orange, N. J.—The United Electric Company has secured a franchise in this city.

Mankato, Minn.—A franchise to erect and operate a gas plant has been granted J. A. Bower.

Edenton, N. C.—Bids will be asked at once for an electric light and water works plant.

Buchanan, Mich.—A municipal electric light plant is contemplated. Geo. H. Black, mayor.

Spokane, Wash.—Bids will probably be asked this fall for constructing the Post Falls plant.

Richmond, Va.—Bids are asked until Oct. 5 for a franchise for a new electric

light and power plant. Sol. L. Bloomberg, prest. coun. Ben. T. August, cy. clk

Ottawa, Can.—The question of establishing a municipal street lighting plant is being considered.

Sandusky, Ill.—The city will sell its electric light plant and equipment to the highest bidder Oct. 12.

Grand Haven, Mich.—The bd. of pub. wks. has decided to expend $10,000 on the improvement of the electric plant.

Exeter, Pa.—Bids are asked until Oct. 6 for furnishing electric lights for the streets of this place. A. O. Farnham.

Culpepper, Va.—Bids will be asked soon for an engine, boiler, alternator, line construction, etc., for an electric light plant. M. A. Reckford, Belair, Md., is in charge.

Eau Claire, Wis.—Sealed bids are asked until 6 p. m. Oct. 5 for lighting the streets of this city with arc lights and the city buildings with incandescent electric lights for a term of 5, 10 or 15 years. J. C. Hennessey, city clk.

Chicago, Ill.—Sealed bids are asked until Oct. 7 for constructing certain works for the conservation of water power on the channel of the Sanitary district of Chicago and the Des Plaines river. Thos. A. Smyth, prest. bd. trustees of Sanitary dist.

Rensselaer, N. Y.—Bids are asked until Oct. 6 for lighting the streets and public buildings with electric lights.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Chicago, Ill.—The sub-committee of the finance committee is in favor of a garbage reduction plant.

Jacksonville, Fla.—The council is desirous of having a garbage disposal crematory erected.

Braddock, Pa.—The committee appointed to consider means of garbage disposal has recommended the building of one or more furnaces.

F. W. Thorold, cy. engr., says this city would like to correspond with the builders of garbage crematories or incinerators.

PARKS.

Plainwell, Mich.—The citizens are raising a fund for establishing a public park.

Grand Rapids, Mich.—The citizens are urging council to purchase 10 acres of land in the north end of the city for a public park.

Minneapolis, Minn.—The park board is preparing plans to continue the practice of planting trees along the streets throughout the city. Since the law providing for this was enacted in 1889 over forty miles of trees have been put down. The board charges $5 a piece for planting the trees and cares for them for three years.

FIRE APPARATUS.

Sandusky, O.—The immediate purchase of new fire engines is urged by Chief Harting.

Wausau, Wis.—Chairman Stelz of the fire committee says the city is in need of new fire hose.

South St. Paul, Minn.—Sealed bids are asked until 9 p. m. Oct. 5 for furnishing 600 feet of two and one-half inch Colton fire hose. C. W. Clark, city recorder.

TOO LATE FOR CLASSIFICATION

Springfield, Ill.—The United States circuit court took under advisement, Sept. 16, the arguments in the case of the Farmers' Loan and Trust Company against the New England W. W. Co. of Alton.

Houston, Tex.—The city council has adopted a resolution directing the city attorney to press the suit against the corporation for forfeiture of charter. The suit is based on failure to carry out the terms of its contract.

Hammond, Ind.—Mandamus proceedings were begun at Crown Point, Ind., Sept. 9 on behalf of Chicago stockholders in the local water works system against the Hon. A. F. Knotts, mayor of this city, to compel him to sign $15,000 worth of warrants, which amount is for water rentals owed the Lake City W. W. Co. by the city of Hammond. Mayor Knotts claims that the city paid an exorbitant price for its stock in the company.

Hannibal, Mo.—Orr & Moetz, city, was awarded the contract for 10,250 ft. of 8 and 12-in. pipe sewers, 13 manholes and 12 lampholes for $4,803.

Pittsburg, Pa.—E. M. Bigelow, dir. pub. wks., estimates the cost of a filtration plant large enough to supply pure water to this city at $7,152,000.

Prophetstown, Ill.—Preliminary work on the water works system may begin this fall.

Gloucester, Mass.—The extension of the city water mains to Bass Rocks is desired by the residents of that place.

San Francisco, Cal.—The South Yuba Water Co. has secured control of all the lakes, water rights and canals of the Pioneer Pulp Co. and Towle Bros. Co. in Placer county, and it is stated that additional works will be constructed to increase the capacity of these plants.

Civil Engineers, Surveyors, Assistants and Inspectors in the Various Branches of Municipal Engineering, Draughtsmen, Superintendents of Paving Brick Plants Foremen for Contractors,

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POSITION WANTED—A graduate civil engineer, with two years' experience in municipal work, desires a position as assistant engineer in city work. Address S. B. W., care MUNICIPAL ENGINEERING.

FOR SALE—1200 acres rock asphalt lands, Uvalde County, Texas. Fine proposition. For prices call upon or address H. L. SMITH, Room 4, Kirth Building, Beaumont, Texas.

SALESMAN WANTED.

One familiar with Fire Brick and Portland Cement. About half time on the road. Address H. & Co., care MUNICIPAL ENGINEERING MAGAZINE.

TO CONTRACTORS.

For grading and constructing good gravel roads and necessary bridges in Bexar county, Texas, to the amount of Five Hundred Thousand Dollars.

Sealed proposals for the above work, addressed to the Commissioners' Court, of Bexar county, Texas, and indorsed with the above title, will be received at the office of the County Clerk, until 12 o'clock of October 10, A. D. 1903, according to plans and specifications to be had on application to Rob't B. Green, County Judge, after September 21, 1903. Address San Antonio, Texas. The County reserves the right to reject any and all bids.

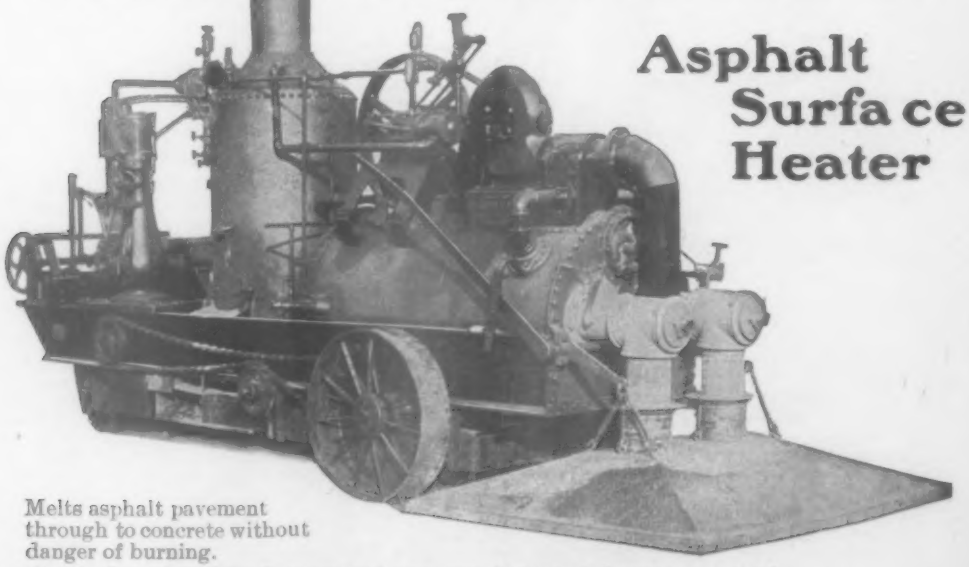
PROPOSALS FOR LIGHTING THE CITY OF EAU CLAIRE.

Sealed proposals will be received by the City of Eau Claire, Wisconsin, until Monday, October 5, 1903, at 6 P. M., for lighting the streets of Eau Claire with arc electric lights and the City Buildings with electric incandescent lights, for a term of five, ten, or fifteen years, from June 1, 1904.

Parties receiving the contract will be granted a franchise upon the usual terms for building conduits, placing poles, overhead wires, etc., for conveying electric current to be used for light, heat, power, or signal purposes. Certified check payable to the order of City Treasurer, in the sum of $1,000, must accompany each proposal. Bids must be addressed to J. A. Osterman, care of City Clerk.

Additional information may be obtained from
J. C. FENNESSEY, City Clerk,
City Building, Eau Claire, Wis.

THE ECONOMIC



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Large capacity. Economically operated. For detailed description and particulars address

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